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Over the past decade housing prices have increased dramatically. The U.S. Environmental Protection Agency sponsored this study to gain a better understanding of the effect of federal environmental regulations on the cost of housing. The study has three parts: a literature survey, case studies of Boston and Dallas, and an econometric analysis. Both the case studies and the literature search suggest that costs from environmental regulations are dependent on the characteristics of the proposed development and the political and administrative context in which this development must be reviewed. In an effort to generalize beyond the case studies, the contractor did a statistical analysis of housing costs. Estimation results did not produce consistent evidence that environmental regulatory variables increase the price of housing. Complex interrelationships among federal, state, and the local development process make it difficult to isolate the effect of federal environmental regulations on housing costs.

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Final Report

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U.S. Environmental Protection Agency
401 M Street, SW
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EXECUTIVE SUMMARY

INTRODUCTION

Over the last decade, howeownership has become an increasingly elusive goal for more and more American families. While the median family income has risen since 1970, a greater increase in the median sales prices of a new single family home during the same period has placed an investment in housing out of reach of many families. The reasons for sharply escalating housing prices are manifold: increases in construction, financing and transactions costs, and, perhaps most importantly, in the cost of developing land.

This study was designed to provide the U.S. Environmental Protection Agency (EPA) with estimates of the nature and extent to which federal environmental regulations affect housing costs. The role played by federal environmental mandates in housing development is difficult to trace, since many are implemented by state and local regulations rather than directly by the federal government. Therefore, these state and local statutes that are actually attributable to federal requirements must be identified, which requires interpreting local land use regulations with some subjectivity.

Most federal environmental statutes pursue public health, welfare and safety goals jointly with the goal of environmental protection. However, this study made no attempt to evaluate the effectiveness of these laws, or to quantify benefits or disbenefits arising from their implementation. This research effort focused entirely upon documenting costs associated with specific regulations. It starts with a comprehensive inventory of federal environmental regulations which can affect housing costs, based on a broad definition of "environmental." Thus, the resulting total cost estimates attributable to federal environmental regulations constitute a probable upper bound--one that would decline if the definition of environmental regulations was more narrowly interpreted. Many of the regulations included here are considered by local decisionmakers or developers to be environmental in scope regardless of Congressional intent.

Two methods were used to document housing costs attributable to federal environmental legislation. First, case studies of nine recent housing developments (completed in 1979 and 1980) in the Boston and Dallas metropolitan areas were conducted, using interviews with developers and project reviewers. Second, because case study results are difficult to generalize to a national context, the case studies were supplemented by an econometric analysis of the impacts of a variety of housing attributes on sales prices, using secondary data from an independent source. A secondary purpose of this study was to test both methods, to determine whether they (singly or jointly) could be used to effectively predict the impacts of EPA's regulations on housing costs.

SECTION 1: CONCEPTUAL FRAMEWORK

Eight laws forming the heart of the federal environmental initiative were reviewed for their potential impacts on housing costs:

- Safe Drinking Water Act (PL 93-523)
- Resource Conservation & Recovery Act (PL 89--272, as amended)
- Clean Water Act (PL 92-500, as amended by PL 95-217)
- Clean Air Act (PL 91-604, PL 92-157 as amended)
- Noise Control Act (PL 92-574, as amended) and the Quiet Communities Act (PL 95-609)
- National Flood Insurance Act (PL 90-448) and the Flood Disaster Protection Actm (PL 93-234)
- National Environmental Policy Act (PL 91-190)
- Coastal Zone Management Act (PL 92-583, as amended)

All of these laws have been enacted or given their present form since 1970. Their implementation has required that they be grafted onto existing processes for development reviews that have traditionally been conducted by local governments.

The costs associated with building a house generally have three components: the cost of the land or site, land development costs (including the provision of required infrastructure), and construction costs. Environmental regulations can directly affect these components in four ways:

- Administrative costs: Regulations may require the developer to study the proposed site, to identify impacts, and to develop mitigation measures. These costs are incurred while the project is reviewed by permitting agencies, and costs can increase when changes in project plans are required.
- Carrying costs: These are incurred as environmental regulations increase the time required for the developer to obtain necessary approvals. Direct carrying costs include the financing of land development, such as property taxes, insurance, and interest on a land loan. Indirect carrying costs are incurred when the delay period is sufficiently long to affect the prices of building materials and labor which rise with inflation.
- Compliance costs: These occur through changes in the costs of building materials and labor which are required to mitigate environmental problems, as mandated by environmental regulations.

- Indirect costs: These are incurred through costs arising from pollution control measures imposed by manufacturers of materials used in construction. This category reporesents the costs of pollution abatement equipment that is included in the materials prices paid by the developer.

Land development costs are the primary focus of this study, because of their direct link to housing costs. Land prices were not emphasized, since they are influenced by many factors other than the absolute supply. Operations and maintenance costs for the finished dwelling are also not dealt with since they are borne by the housing consumer rather than the developer.

A review of literature concerning the relationship of these categories of housing costs to environmental requirements (mandated by all levels of government) found that consistent estimates of impact are not generally available on a comprehensive basis. Most work in this field has been undertaken on a case study basis, where data is applicable only to site specific contexts. By far, the most comprehensive analyses are those that have been performed on EIS and CZM legislation. But, even here, little consensus among studies exists. In fact, these programs do not affect much of the housing being built in this country today: for example, the size thresholds established for EIS review are sufficiently large as to exempt many developments, particularly in those parts of the country in which large housing projects are not common. Obviously, the CZM program does not apply in areas which are not part of a coastal zone. A brief survey of the literature points out that additional research is needed to understand in more detail the cost impacts of environmental regulations upon the new housing market.

The impacts of eight federal environmental laws and their implementing regulations were reviewed to identify their potential for affecting housing costs. This analysis, which is summarized in Exhibit E-1, found that these laws and regulations under study could potentially affect each category of cost:

EXHIBIT E-1

SUMMARY OF POTENTIAL COST IMPACTS OF FEDERAL ENVIRONMENTAL LEGISLATION

Legislation	Direct Developer Costs				Other Costs	
	Administrative	Carrying	Compliance	Impact	Land Prices	Operating
Safe Drinking Water Act		-delays from EPA reviews of projects affecting sole source aquifer areas	-mitigating impacts in sole source aquifer recharge areas			-user charges for upgrading supplies to meet MCLs, mitigating impacts in sole source aquifer recharge areas
Resource Conservation and Recovery Act				-materials costs reflect hazardous waste management requirements		-charges and/or increases in property taxes for upgrading disposal facilities
Clean Water Act	-special studies of wastewater management issues may be needed for point & nonpoint sources	-limits on sewerage capacity may delay project approvals -delays can result from reviews of management strategies for point & nonpoint sources	-special sanitary or nonpoint wastewater management measures	-pretreatment, direct discharge, new source performance & toxic effluent standards affect materials costs	-limits on sewerage capacity may limit supply of land available for development	-user charges for wastewater management controls, increases in property taxes for capital expenditures
Clean Air Act			-asbestos regulations will affect construction practices	-stationary source controls required by NSPS, NESHAPS, & existing source controls -mobile source controls of heavy construction equipment	-control strategies could affect land development patterns	-emission limits reflected in higher utility bills -emission controls on home furnaces, etc. may lead to higher fuel and/or equipment costs
Noise Legislation	-design requirements for noise reduction		-regulation of construction activities	-increased costs for construction equipment		-increased costs of operating municipal equipment
Flood Disaster Protection and Insurance Acts	-flood hazard studies, mitigation design		-costs of elevating structures & roads -opportunity costs of land prohibited from development		-control measures which restrict the supply of land for building	-insurance payments -costs of floodproofing services
National Environmental Protection Act	-preparation of EIAs, EISs	-carrying costs during EIS review -increased financing costs for subsidy programs	-construction of mitigation measures	-EIS preparation costs for industrial facilities		-EIS preparation costs for public facilities
Coastal Zone Management Act		-assessments, permit procedures may affect review time	-construction of mitigation for sensitive areas		-strategies may affect the supply of land	

- Administrative costs are affected by requirements for special studies or for specialized design and engineering work. The laws with the highest potential for major impacts in this category are the Clean Water Act, NEPA, and the noise and flood protection laws.

- Carrying costs are obviously most affected by laws which require additional reviews by federal, state, or local governments. These reviews can lengthen a project's plannin period, thus increasing property taxes, insurance and land financing payments, as well as making the project more vulnerable to inflation. The federal environmental laws with the highest potential for affecting carrying costs are the Safe Drinking Water Act, the Clean Water Act, NEPA, and the Coastal Zone Management Act.

- Compliance costs can be affected by all but one of these laws. Only the Resource Conservation and Recovery Act does not require mitigation of problems by individual developers. All of the other laws have the potential to require the developer to mitigate environmental problems--either through changes or additions to the project design, or through reductions in the project's scope. This cost category includes expenses for building materials, equipment and labor necessary to construct mitigation measures. It also includes costs which may be incurred through requirements affecting construction practices. These could include soil erosion control measures required under the Clean Water Act, asbestos management strategies required under the Clean Air Act, or measures which confine construction to daylight hours to minimize noise impacts.

- Several federal environmental laws have the potential to affect a housing project's indirect costs through pollution control requirements for manufacturers of building materials. The three laws with the potential for the highest costs in this category are those that directly regulate emissions: the Clean Water Act, the Clean Air Act, and RCRA's hazardous waste management requirements. In addition, NEPA can potentially increase the costs of input materials as EISs are required for new industrial facilities, and noise legislation can increase the cost of construction equipment as machines become specially fitted to reduce noise levels.

These laws also affect other costs in several ways. Land prices are affected as these requirements are implemented in such a way as to decrease the supply of land available for housing development in a community. The costs of operating and maintaining a housing unit are also affected by most of these laws, which have the potential to require user charges or increases in property taxes to pay for the development and implementation of mitigation measures. Several laws can potentially affect energy requirements, and thus a housing unit's operating costs.

It should be noted that the law with the highest potential for affecting housing costs is the Clean Water Act, the only law of the eight examined which affects all four types of cost. Its requirements for management of both point and nonpoint sources of water pollution, as well as the effluent limits placed on manufacturers of building materials have resulted in costs which were previously borne externally (e.g., by downstream water users) if at all.

SECTION 2: EMPIRICAL EVIDENCE

The previous section attempted to provide a framework within which an analysis of the impacts of these laws and regulations on housing costs may be performed. To evaluate these impacts in terms of their real incidence and magnitude, it is also necessary to understand the ways in which they have been implemented. Nine case studies of individual housing developments in two metropolitan areas were undertaken in the Spring and Summer of 1980. The developments were in the Boston and Dallas metropolitan areas , which have experienced dramatically different rates of growth over the last twenty years.

The case studies were selected specifically because the development had encountered environmental regulation at some stage in the project development. In Boston, towns were selected which had developed local review processes in which environmental issues were specifically considered. Through interviews with town officials and developers, four developments which had encountered at least one of the environmental regulations of concern were selected for case study analysis.[1] Local development reviews in the Dallas area cases were selected on the basis of interviews with local and regional planners, who suggested developments that had encountered any type of environmental regulation. Five Dallas area housing developments were selected for case study analysis. The characteristics of each case are described in Exhibit E-2.

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[1] See Appendix A.

The nine case study developments were selected specifically because they had encountered some type of environmental regulation. Therefore, the cost estimates derived for each represent a probably upper bound for costs attributable to environmental requirements.

Estimates of costs incurred by the case study developers were based upon extensive interviews and were supplemented by reviews of project files.[1] These reported costs were categorized according to the typology presented in Section 1 -- i.e., as to whether they were administrative, carrying, compliance or input costs. For each category of cost, factors to which they may have been sensitive were also examined. This sensitivity analysis resulted in the production of a set of costs which were adjusted for consistency across all nine cases.

The reported and adjusted environmental costs are summarized in Exhibit E-3. This exhibit shows that the overall costs as reported in interviews are significant expenditures in terms of the project's value in all cases. This exhibit also indicates that project size or density does not have a great effect on these costs: the highest per-unit reported costs are found with the lowest density projects in both Boston and Dallas cases. In general, reported costs attributable to environmental regulations are higher in the Boston area than they are for the Dallas cases. This is due primarily to longer review periods and the involvement of a greater number of agencies in environmental reviews in the Boston area than in Dallas. While this may in turn be a reflection of attitudinal differences towards growth and its management in the two areas, it is also a reflection of the relative scarcity of prime buildable

---

[1] A copy of the interview guide can be found in Appendix C.

EXHIBIT E-2

SUMMARY OF CASE STUDIES

CASE		TYPE OF PROJECT	TOTAL PLANNED UNITS	UNITS COMPLETED	TOTAL PROJECT ACREAGE	GROSS BUILT DENSITY	TOTAL PROJECT VALUE	VALUE/ UNIT	FEDERAL SUBSIDY
Boston:	B1	Multifamily (rental)	266	266	26	10.2 du/acre	$11,771,584*	$44,254	Section 8
	B2	Single family	39	39	39	1.0/acre	2,715,812	49,636	None
	B3	Multifamily	600	172	60	10.0 du/acre	34,166,972	46,945	None
	B4	Single family	65	65	45	1.4 du/acre	4,390,909	67,552	None
Dallas:	D1	Single family**	2600	2200	700	3.1 du/acre	156,000,000	60,000	Mortgage Insurance
	D2	Single family/ Multifamily mix***	1400	1400	516	2.7 du/acre	84,000,000	60,000	Mortgage Insurance
	D3	Single family	202	202	78	2.6 du/acre	11,918,000	59,000	None
	D4	Single family	490	65	327^+	1.5^+du/acre	103,800,000	212,000	None
	D5	Single family	444	110	133	3.3 du/acre	28,860,000	65,000	Mortgage Insurance

*Calculated on the basis of total emplacement costs.

**An additional 400 units of multifamily housing are planned but have not yet been built. Cost estimates were available only for the single family portion of the project.

***Plans also call for the development of an additional 32 acres for office and retail uses. Estimates of costs include only the housing portion of this project.

$^+$Total Project Acreage was calculated on the assumption that the overall density would equal that of the first completed segment.

EXHIBIT E-3

SUMMARY OF COSTS
Cost/Dwelling Unit

Case	# of Com-pleted Units	Project Value/ Unit	All Environmental Costs		Federal Environmental Costs			
					Reported		Adjusted	
			Reported	Adjusted	Amount	% of Total Reported	Amount	% of Total Adjusted
Boston: B1	266	$44,300	$12,760	$1500	$2250	18%	$ 950	63%
B2	39	64,600	13,360	6640	3860	29%	4820	73%
B3	172	56,900	15,490	4000	6730	43%	2000	50%
B4	65	67,600	16,710	2030	920	6%	920	45%
Dallas: D1	2200	60,000	2,920	1640	1820	62%	1310	80%
D2	1400	60,000	9,030	750	3240	36%	1040	--
D3	202	59,000	5,320	230	1420	27%	760	--
D4	65	212,000	9,760	4930	2990	31%	2990	61%
D5	110	65,000	3,710	1920	1310	35%	720	78%
AVERAGE		76,600	9,900	2630	2730	28%	1720	65%

land in the Boston metropolitan area. Local officials in the Boston area were more concerned than those in Dallas about the impacts of these developments upon the existing community infrastructure. These concerns are also reflected at the state level by the involvement of several Massachusetts agencies in development review; in Dallas, the state was not involved at all in reviewing the five projects.

The assumptions used to adjust these costs for consistency tend to soften these regional differences somewhat. With the exception of one case (B2), adjusted costs in the Boston and Dallas projects tended to be closer to the mean. This is due primarily to an adjustment which dismissed inflation costs that are associated with inflation in the economy as a whole. With the inclusion of only relative inflation, the differences attributable to various review periods are minimized.

Because housing developments are so varied in their design and thus in their costs, the estimated expenditures for meeting environmental requirements drawn from these nine cases cannot be seen as representative of the experience of the entire housing industry. However, some conclusions can be drawn from these cases about the relative importance of the costs of all environmental requirements, as summarized in Exhibit E-4.:

> Administrative costs: These are the least important of the four types in all three scenarios, accounting for 6% of total adjusted environmental costs. While this may be partly due to under-reporting, these costs on a per unit basis are almost negligible when compared with carrying or compliance costs.
>
> Carrying costs: As reported by developers, these play a major role in determining the total level of costs incurred to meet environmental requirements (70% of all reported environmental costs). However, these costs are highly sensitive to assumptions of the length of the planning period (or the documentation of true delays caused by environmental reviews). Some of the direct carrying costs can be shifted from the developer to the landowner simply by not purchasing land outright until all of the necessary permits have been obtained. This lowered cost estimates reported in interviews, but tends to understate the real level of costs in this category, since these direct carrying costs cannot be avoided by all parties.

EXHIBIT E-4

SUMMARY OF AVERAGE CASE STUDY ENVIRONMENTAL COSTS
(Cost/Dwelling Unit)

	Costs Reported by Developers				Costs Adjusted for Consistency			
	Total Reported	% Total Reported	Federal Reported	% Federal Reported	Total Adjusted	% Total Adjusted	Federal Adjusted	% Federal Adjusted
Administrative	$ 160	2%	$ 50	2%	$ 160	6%	$ 50	3%
Carrying	7,060	71%	1,270	47%	950	36%	160	9%
Compliance	1,490	15%	230	8%	330	13%	330	19%
Input	1,190	12%	1,190	44%	1,190	45%	1,190	69%
TOTAL	9,900	100%	2,730	100%	2,630	100%	1,720	100%

Inflation is largest single cost in this category, and makes this category an important factor in determining overall costs. However, when these costs are adjusted to account for inflation in the economy as a whole, this type of cost is much less significant than originally reported. Inflation in the homebuilding industry does not appear to be significantly different from inflation in the economy as a whole. When adjusted costs are considered, the overall impact of carrying costs diminishes greatly. The high inflation costs reported in interviews consider expenditures in, say, 1975 and 1979 without correcting for the different values of 1975 and 1979 dollars.

Compliance costs: These present the greatest difficulty in attribution. The most expensive items in this category (e.g., sewer systems) have traditionally been considered necessary for protection of public health. The goal of environmental improvement has been added relatively recently. Therefore, these expenditures tend to be minimized by developers, since they are costs which would be incurred in building any development in any part of the country. The real problem becomes one of marginal attribution: what was required of the development for non-environmental wastewater management that would have been different in the absence of federal environmental regulations? Interviews used to develop the nine case studies did not provide consistent answers.

Input costs: These represent a significant portion of costs incurred to meet environmental regulations. They are also entirely attributed to federal requirements.

Exhibit E-4 also shows that the importance of federal environmental requirements shifts somewhat as costs are adjusted for consistency. This may be due in part to different perceptions held by developers which affected the costs reported in interviews. A comparison of reported costs attributable to federal regulations with adjusted "federal" costs shows that twenty-seven percent of the estimated reported costs incurred by environmental requirements can be attributed to federal requirements. However, many of the costs dismissed in the adjustment process were non-federal in nature, the adjustment process left primarily costs incurred in meeting specific federal requirements (68%). As costs were adjusted for consistency, the importance of the various categories of federal costs shifted. As carrying costs became less important due to consideration of inflation in the overall economy, the relative importance of input costs increased by 25%.

In summary, the proportion of environmental costs attributable directly to federal requirements is highly dependent on the assumptions used in preparing estimates--in short, on the types of actions which are included.

While Section 1 presents a comprehensive list of statutes which could potentially affect the cost of housing, it is important to note that many of their regulations have yet to be implemented at the local level in such a way that individual projects are affected. The costs which had the greatest impact upon these nine cases stemmed from three requirements:

- Environmental assessment requirements, from the National Environmental Policy Act,
- Management of sanitary wastewater as required in the Clean Water Act, and
- Restrictions upon building in floodprone areas, from the National Flood Insurance Program.

Several types of regulations which had the potential to impact housing development were not found to be important. These included:

- Coastal Zone Management requirements. In Massachusetts, housing has not been a major component in new development in the coastal zone, and Dallas is far from Texas' coast.
- Management of nonpoint wastewater, such as federal requirements for stormwater management, from the Clean Water Act. In Massachusetts and in Texas, stormwater has traditionally been a concern of subdivision regulations and is frequently not considered an environmental requirement. Similarly, wetland protection is a state concern in Massachusetts, and federally-sponsored plans which would regulate development in or adjacent to wetlands have not yet been implemented.
- Municipal solid waste disposal, as mandated by the Resource Conservation and Recovery Act. In neither the Boston nor Dallas areas were cases found that were materially affected by closings of existing dumps or landfills. As suitable disposal sites become more scarce, this may have an impact on housing development costs in the future, but is not a concern of individual developers at present.

- Requirements concerning either point or mobile air pollution emissions, from the Clean Air Act. In both the Boston and Dallas areas, housing is not considered to be an important source of either type of air pollution, and is thus not regulated from this standpoint.

While it is possible that these requirements may become more important in determining the costs of building housing in the future, these nine cases were not able to address their present impact. Several cases (primarily those in the Boston area) were affected by state or local regulations which paralleled these federal requirements; their impacts are described above. However, these costs cannot be included in estimates of the impact of present federal environmental requirements, since they have yet to be implemented at the federal level. As was true with wastewater management, some federal environmental goals are found in state and local requirements as well: this coincidence of objectives makes an accurate estimation of the impact of purely federal requirements difficult at best.

SECTION 3: ANALYSIS OF SECONDARY DATA

The results of the case study analysis, while generally consistent with the results of similar studies, are limited in that they cannot be generalized to a broader geographic context. Nor can the research methodology be easily reproduced. This section attempts to answer the question, "Are there alternative research methodologies which can achieve the same objectives easily and at less expense?"

One such possibility is econometric modeling. An econometric model was applied to secondary data to determine whether such a framework is sensitive enough to detect how environmental regulations, specified in a more generic sense, impact housing costs. It does this by specifying a hedonic price model which uses sales price as the dependent variable and housing and neighborhood attributes, including selected environmental regulations, as independent variables. Results of the test are interpreted by examining coefficients for sign, magnitude and statistical significance.

This analysis used detailed information on over 1000 sales of single family homes in 20 jurisdictions in the Boston metropolitan area to statistically test the impact of environmental regulations on housing prices. The types of environmental regulations and surrogates examined in this analysis were:

- 1-2 acre minimum lot size zoning
- National Flood Insurance: participation in the program's Regular Phase
- Special zoning for Planned Unit Developments (PUD)
- Erosion/Wetlands/Watershed protection

Because of the experimental nature of this aspect of the research effort, some limitations must be placed on the analysis. Foremost is the set of environmental regulations included in the econometric specification. As the incidence of federal environmental regulations enforced at the local level was found in case studies to be rather unsystematic, regulations explored in this chapter are those that have been applied more or less consistently across the study area, regardless of which level of government promulgated them. This approach was taken only to assure that meaningful results could be obtained from this exercise, and that further research could refine variable specification to accommodate the needs of EPA.

Exhibit E-5 presents the results of the empirical estimtes. Unfortunately, theory tells us very little about the nature of functional relationships among the attributes of a housing bundle. As a consequence, two specifications were estimated: a linear model and a semi-log model.

Overall, the equation works quite well. Depending on which of the two forms is selected, there are either 11 or 13 structural and neighborhood variables significant at the 1% level. The R^2's suggest that the models explain between 74 and 77 percent of the total variation in sales price.

EXHIBIT E-5

SUMMARY OF ESTIMATED ENVIRONMENTAL REGULATION IMPACTS

	$ Premium	t	% Premium[1]	t
Flood Insurance Plan	-1,062	.79	-10.6	4.92*
Wetlands Protection	-9,985	2.94*	-21.0	4.13*
Large Lotsize Zoning	+2,311	2.17**	+ 4.3	2.36**
Special Zoning PUD	-5,573	1.59	- 5.0	1.93

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[1] Percent premium is $\frac{\text{P Reg}}{\text{P Unreg}} - 1$ where P Reg is the price of housing in the regulated area and P Unreg is the price in the non-regulated area. It is calculated by transforming the semilog regression coefficient.

If the regulation in question is reflected by a dummy variable with coefficient , we know

$$\text{LOG P Reg} = \Sigma\beta iXi + \gamma$$

$$\text{LOG P Unreg} = \Sigma\beta iXi$$

Thus,

$$\text{LOG P Reg} - \text{LOG P Unreg} = \gamma$$

Thus,

$$\frac{\text{P Reg}}{\text{P Unreg}} = e^{\gamma}$$

and,

$$\frac{\text{P Reg}}{\text{P Unreg}} - 1 = \underline{e^{\gamma}-1}$$

*Two tailed t-test significant at the 1% level.

**Two tailed t-test significant at the 5% level.

Exhibit E-6 presents a summary of the results of hypothesis tests on the four environmental variables. Since the sign of the net effect is difficult to predict in each case, two tailed t-tests were used in all four significance tests.

The easiest result to explain concerns large lot zoning, which is consistent with the results of previous studies. On balance, the equation suggests that large lot zoning tends to increase housing prices by about 4.3% or by $2,311 in the linear model. The variable is significant in both equations. This result, however, applies to the geographical area under study, and cannot necessarily be generalized to other parts of the United States. In addition, the net increase is a one time only increment; it is not an annual increase of 4.3%.

With respect to other environmental variables examined, housing in communities with special zoning for planned unit development (PUD) does not seem to be selling for prices above those in other areas. The most puzzling result is the large negative coefficient on the "wetlands protection" variable which is significant at the 1% level in both specifications. It suggests that housing in towns which are subject to the provisions of the Massachusetts Wetlands Protection Act seems to be selling for about 21% less than comparable housing elsewhere. Seventeen of the twenty towns in the sample do in fact have wetlands zoning restrictions. If there was some positive factor associated only with the three towns which do not have such zoning restrictions, and if those factors were left out of the equation, the wetlands zoning variable would be negative and significant. Thus, the seemingly strange estimate could be the result of omitted variable bias.[1] It is clear that the likelihood of omitted variable bias is quite high when the number of towns in the "control group" is small.

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[1] The three towns are Cambridge, Natick and Quincy; all three are near centers of employment. Cambridge and Quincy have significantly higher densities than the rest.

EXHIBIT E-6

LINEAR AND SEMILOG ESTIMATES OF HEDONIC PRICE INDEXES

N = 1016

	Linear		Semilog	
	$\hat{\beta}$	t-statistic	$\hat{\beta}$	t-statistic
Lot Size (sq. ft.)	.256	6.99*	.0000048	7.83*
Number of Rooms (#)	279	.52	.036	3.90*
Number of Bedrooms (#)	36	.04	-.002	.20
Number of Bathrooms (#)	9,703	9.97*	.103	6.24*
Number of Half Baths (#)	4,202	4.91*	.082	5.64*
Interior Space (sq. ft.)	10.93	10.66*	.000081	4.68*
Year Built (1900=0; 1971=71)	38.7	2.05**	.0015	4.75*
Quality of Construction (1-5; 5=best)	2,114	2.60*	.037	2.68*
Condition (1-5; 5=best)	4,438	7.37*	.112	11.01*
Fireplaces (#)	6,573	10.44*	.095	8.93*
Pool (1=yes; 0=no)	-2,622	.86	.0064	.04
Local Tax Rate (per $1100 Mkt. Val.)	-903	6.07*	-.015	5.79*
Driving Time (minutes)	688	5.60*	.0039	1.89
Per Pupil Expenditures ($'s)	-5.50	1.05	-.00021	2.38*
Population Density (pop/sq.mi)	5.19	7.55*	.000074	6.37*
% Single-Family	-158	3.36*	.0015	1.82
Median Income ($'s)	4.11	6.99*	.000072	7.27*
Flood Insurance PGM (1=yes)	-1,062	.79	-.112	4.92***
Wetlands Protection (1=yes)	-9,985	2.94***	-.236	4.13***
Large Lotsize Zoning (1=yes)	2,311	2.17****	.042	2.36****
Special Zoning for P.U.D. (1=yes)	-5,573	1.59	-.051	1.93
Constant	23,241	--	9.82	--
R^2	.77	--	.74	--

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*One tailed t-test significant at the 1% level.

**One tailed t-test significant at the 2.5% level.

*** Two tailed t-test significant at the 1% level.

****Two tailed t-test significant at the 5% level.

A similar result was obtained on the flood insurance variable, although it is only significant in the semi-log equation. Properties in jurisdictions which participate in the National Flood Insurance Program seem to sell for about 10% less than identical houses in areas which do not. Once again there is the possibility of omitted variable bias.

However, an alternative interpretation for the estimated coefficients associated with the last two cases is that the programs (wetlands and flood insurance) in question are designed to deal with a "*negative*" environmental quality. Since only those towns with that quality will have the regulation, there would be no way to separate the negative impact of the quality on housing value from the positive impact of the regulation pm sales price.

The statistical analysis presented provides little evidence for the premise that the environmental regulations in question have served to significantly increase the price of housing in the jurisdictions where they are imposed. Only the imposition of large lot zoning requirements seems to have increased prices; this effect seems to have been small (4.3%).

The fact that the equations show evidence of *lower* prices in some regulated areas seems to illustrate two important points. First, environmental regulations are enacted to alter the environment and since the environment (broadly defined) can be thought of as part of the housing bundle, an analysis of selling prices cannot entirely separate the effects of a regulation on the *quality* of housing from its effects on the *price* of housing.

Second, since regulations are often enacted to deal with negative environmental qualities which *themselves* tend to supress land values, statistical analysts might be tempted to attribute the *lower* prices resulting from the negative attribute to the presence of the regulation. The regulation itself may in fact have *increased* prices above their already suppressed level.

SECTION 4: CONCLUSIONS

While an examination of the literature shows that environmental regulations attributable to all levels of government have been investigated in some depth, there has been no systematic evaluation of the extent to which a specific level of government is responsible for the environmental costs borne by the consumers of new housing. Accompanying much of the literature, particularly in research sponsored by construction industry associations, have been calls for regulatory reform to reduce development costs. These calls appear to be particularly unfocused in terms of both the appropriate level of government and specific regulatory programs, given the absence of attribution in most of the studies reviewed.

Of the eight major federal environmental laws considered in this study, only housing cost impacts of provisions of the National Environmental Policy Act and the Coastal Zone Management Act have been investigated in depth in the literature. Therefore, Section 1 of this report describes theoretical cost impact chains for all eight of the major federal laws. The case studies which follow represent an attempt to trace these linkages empirically.

The case study analysis used two metropolitan areas--Boston and Dallas--that differed markedly in population growth, environmental background, political background and attitudes toward growth. These case studies supported the findings found in the literature: with respect to environmental regulations, costs are highly dependent upon the characteristics of the proposed development, the ambient environmental background in which it is to be situated, and perhaps most importantly, the political and administrative context in which the development must be reviewed. Despite the advantages of this approach in providing empirical documentation of impacts, case study techniques preclude generalizing cost estimates beyond the local context to which they apply.

Other difficulties with the case study approach involve the reliability of accurate data concerning incurred costs. The method used in his research involved collecting data concerning all development costs from planners and builders, with attribution of costs to various regulations undertaken by the researchers. However, for many cases, detailed data were not available--either because the developer did not maintain full files on completed projects, or because this type of data was not developed at all. In addition, questions of project timing were found to be open to some dispute. The case study approach remains extremely localized and research-intensive, and of limited value in drawing national conclusions.

In an attempt to generalize the findings of these nine case studies, the research effort took a second approach to estimating regulatory costs. Two versions of a hedonic price model were constructed which related the sales price of a house to variables representing the environmental policies of the community in which the dwelling is situated. The models were estimated upon data that were available from secondary sources, except for regulatory data that were collected as part of the case studies. Estimation results did not produce consistent evidence that regulatory variables of an environmental nature increase the price of housing.

However, as the analysis revealed several anomalies in the data, these results must be interpreted with caution. Measurement difficulties precluded the incorporation of many regulatory variables into the econometric specifications. Furthermore, those that were specified were represented only as dummy variables, indicating regulatory incidence in the community rather than specific regulatory provisions. Omitted variable bias could be obfuscating the true impacts of these regulations.

Based upon limited empirical evidence, development of a model to estimate the impacts of environmental regulations on housing costs is expected to reap limited dividends. The extremely local nature of environmental impacts, problems of variable specification (particularly with respect to environmental regulations at all levels of government), and the sheer complexity of the relationships involved in the development process are limiting factors which can only detract from such a model's abilities.

Clearly, the results of this research effort are not definitive, as it has examined only a small number of developments in two metropolitan areas to substantiate its conclusions. However, its results are suggestive of the complex interrelationships among local, state and federal regulations which interact with the private land development process, and of the difficulties in winnowing out only the federal contribution to the impacts of these regulations on housing costs.

CHAPTER 1

INTRODUCTION

1.0 INTRODUCTION

Over the past decade, homeownership has become an increasingly elusive goal for more and more American families. While the median family income has risen since 1970, the greater increase in the median sales price of a new single family home during the same period has placed an investment in housing out of reach of many families. In addition, the costs of maintaining a home (including mortgage principal and interest payments, taxes, and utilities) have increased almost 20% more than the Consumer Price Index since 1970. Both of these factors have contributed to a substantial decline in the proportion of families able to purchase a median-priced home while keeping housing expenditures to 25% of their income.

The reasons for sharply escalating housing prices are many. Construction costs alone (including expenditures for materials and labor) doubled between 1972 and 1979. Financing and transactions costs have also increased since 1970, although not at the rate of construction cost increases. Perhaps the most significant increases were found in land development costs: planning, site clearing and grading, road building and providing infrastructure. Land development costs have risen so rapidly that they now account for approximately 25% of the total cost of a single family house compared to 21% in 1970, and only 11% in 1950.

While land development costs have increased partly because of rising raw land costs and additional improvements to finished lots in response to consumer demand, concern has been voiced increasingly over the role of government regulation in this inflationary trend. Several studies have attributed much of the recent increase in these costs to land development regulations, particularly locally-enforced subdivision, zoning and environmental regulation. To a lesser degree, state and federal environmental regulations have also been cited for their impacts on housing costs, though empirical support for these contentions is not as strong.

As federal regulatory activity in the environmental area has grown considerably since the passage of the National Environmental Policy Act in 1969, the role of the federal government in the housing development process and the subsequent impacts on housing costs cannot be overlooked. While the U.S. Environmental Protection Agency (EPA) examines costs and industry impacts of each of its new regulations, this study was designed to provide EPA with estimates of the nature and extent to which federal environmental regulations cumulatively affect housing costs. In doing so, it traces the linkages between selected federal environmental legislation and the local land development process to determine the degree of federal involvement in the development of new housing.

Even in a theoretical sense, this type of study presents problems that are not found with regulatory impact studies of most industries. The role played by federal environmental mandates in housing development is difficult to trace, since many are implemented by state and local regulations, rather than directly by federal agencies. In addition, many states and local governments have adopted environmental regulations which share federal goals but which are not specifically required by the federal government. Therefore, this study gathered data from developers concerning expenditures for all environmental matters. Costs attributable to federal requirements were then identified as consistently as possible.

The residential development process is extremely localized; it is traditionally administered and regulated primarily by local government agencies created by state enabling legislation. As a result, federal regulations which affect land development are often subject to interpretation in their implementation, usually in the context of land use controls, by lower levels of government. These interactions create the problem of determining which statutes at the local level are actually attributable to federal regulations, a problem that is overcome only by interpreting local land use regulations with some subjectivity.

In this study, federal environmental mandates were defined as broadly as possible. Most federal environmental statutes pursue public health, safety, and welfare goals jointly with the goal of environmental protection. Benefits (both quantifiable and unquantifiable) from regulations promulgated under these statutes may outweigh costs incurred in their implementation. For example, one of the costs associated with the Clean Water Act is that of sewer construction; few would argue that the decrease in infectious waterborne disease resulting from modern sanitation practices has no value to society. However, questions remain concerning the appropriate levels of costs associated with different regulatory strategies. Much debate currently surrounds the issue of defining an appropriate role for the federal government in requiring certain costs to be incurred by the private sector.

Claims have been made by several interest groups that environmental regulations are largely responsible for increases in land development costs that have occurred over the past decade--i.e., these costs exceed by far benefits associated with these regulations. However, there is little hard evidence to either prove or disprove these contentions. This study represents a serious attempt to provide evidence for environmental regulations that have been subject to the least empirical scrutiny: those emanating from the federal government. In conducting this research, efforts have focused entirely upon documenting costs. An assessment of benefits associated with each area of federal environmental legislation remain for future study. Therefore, it is important to note that this report makes no attempt to either relate costs associated with implementing federal environmental requirements to benefits or disbenefits, or to evaluate these laws and regulations in terms of their effectiveness.

Even in a study limited strictly to the costs associated with various legislation, several conceptual problems were encountered. There were no difficulties in identifying the major building blocks of the federal environmental initiative: the National Environmental Policy Act, the Clean Water and Clean Air Acts, and the Resource Conservation and Recovery Act. However, the environmental implications of several other major legislative initiatives also became evident as the project progressed. For example, both the Safe Drinking Water Act and the Flood Insurance Act, whose purposes were primarily public safety, were found to have implications for the treatment of environmental concerns (such as land use and protection of sensitive areas) in the housing development process. Therefore, these laws were also examined to identify their impacts on housing costs.

To provide a comprehensive inventory of federal regulations which can affect housing costs, this study has taken a rather liberal approach in categorizing regulations which are "environmental". This approach allows impacts to be traced through intermediate links of state and local implementation. In doing so, it is recognized that resulting total cost estimates attributable to federal environmental regulations are likely to constitute an upper bound--one that would decline if the definition of environmental regulations was more conservatively interpreted. An inclusive approach was taken in the following analysis, therefore, regardless of Congressional intent: many of the regulations included in this study are considered by local decisionmakers and developers to be environmental. Assessing their cost impacts on the local residential development process should provide a baseline against which impacts of the truly federal environmental requirements could be assessed.

This study was undertaken for two purposes: First, it was intended to document costs incurred in the process of developing housing that are attributable to federal environmental requirements. Two methods were used in the course of this research. First, a series of case studies of nine housing developments completed in 1979 and 1980 in the Boston and Dallas metropolitan areas were conducted. These cases were based upon interviews with developers and project reviewers. The case studies were supplemented by an econometric analysis of the impacts of a variety of housing attributes on sales prices. The second purpose of this study was to test both methods, and to determine whether they could be used effectively to predict the impacts of EPA's regulations upon housing costs.

In this effort, eight federal laws were reviewed for their potential impacts on housing costs. These laws form the bulk of the federal environmental initiative:

- Safe Drinking Water Act (PL 93-523)
- Resource Conservation & Recovery Act (PL 89--272, as amended)
- Clean Water Act (PL 92-500, as amended by PL 95-217)
- Clean Air Act (PL 91-604, PL 92-157 as amended)
- Noise Control Act (PL 92-574, as amended) and the Quiet Communities Act (PL 95-609)
- National Flood Insurance Act (PL 90-448) and the Flood Disaster Protection Actm (PL 93-234)
- National Environmental Policy Act (PL 91-190)
- Coastal Zone Management Act (PL 92-583, as amended)

All of these laws have been enacted or given their present form since 1970. As such, their implementation has required that they are grafted onto an existing (and sometimes complicated) process for development reviews that have traditionally been conducted by local governments.

Due to the intracacies of the chain of impacts of federal environmental regulations upon housing costs, the results of this research effort are presented in three distinct stages. In Section 1, a conceptual framework for this analysis is constructed. The relationships between federal environmental requirements and the land development process are identified, and the types of costs incurred in homebuilding are defined in terms of how they can be affected by the regulatory structure. In this section, Chapter 2 describes the cost typology and impact categories which provide the basis for analyzing the results of this study, and summarizes literature concerning previous research in this area. Chapter 3 describes in detail the potential linkages between the eight major federal environmental laws and housing costs.

Section 2 presents case studies undertaken to provide empirical evidence of the links between these federal environmental mandates and housing costs. Chapter 4 describes environmental costs incurred by four individual developments in the Boston metropolitan area, and Chapter 5 describes five case studies undertaken in the Dallas area. The results of these cases are analyzed in Chapter 6.

Because case studies are, by their nature, not generalizable to a larger context, an econometric analysis of the impacts of various housing attributes on sales prices was undertaken. This analysis is the subject of Section 3, and the effects of key environmental variables are summarized in Chapter 7. Finally, findings from both the case study and econometric approach are summarized in Section 4 (Chapter 8).

SECTION ONE

ANALYTIC FRAMEWORK

CHAPTER 2

BACKGROUND AND LITERATURE REVIEW

2.0 INTRODUCTION

Although several studies have assessed the impacts of environmental regulations on housing costs, few estimates can be generalized beyond the individual communities. Research efforts have varied significantly in terms of methodological approach and the definitions of environmental regulations examined, the latter ranging from local zoning and land use ordinances to state and Federal environmental review requirements. Such variations have obviously contributed to substantial disagreements among conclusions drawn from studies addressing this issue. Regardless of the uncertainties associated with cost estimates, there is a general belief that most federal environmental regulations have adopted in the last decade have increased the cost of housing.

Federal environmental requirements affect the process of building housing in many ways: a federal law may establish goals and objectives for state (or even local) environmental programs; implementing regulations promulgated by federal agencies may only direct states and local governments in how to plan to meet these objectives. Translating these regulations into specific instructions for housing developers and builders is often subject to a range of interpretations that vary from one level of government to another, as well as geographically. Because the chain of impacts of these regulations upon the housing industry is frequently indirect and varied, it is necessary to understand how general environmental concerns in general are typically dealt with in the development process, and to understand how federal initiatives interact with traditional development controls to affect the cost of housing production.

This chapter describes the conceptual framework within which the analysis of cost impacts of federal regulations was conducted. The following sections examine the context of general environmental regulation within the land development process, and define components of housing costs which form the basis for the rest of this research report. Finally, documented relationships between land use controls and housing developers' costs are described. This framework is followed in Chapter 3 by a detailed discussion of the ways in which specific federal environmental initiatives potentially affect each type of housing cost.

2.1 REGULATING ENVIRONMENTAL ISSUES IN HOUSING DEVELOPMENT

Much new housing in this country is built in the form of large developments, such as condominiums or apartment complexes, or as single-family subdivisions. Except in rural locations, two land use controls generally provide communities with their major tools for reviewing and controlling these types of developments: the zoning by-law and the subdivision ordinance.[1] Zoning's major effect on development is its control of the type of activities (i.e., residential, commercial, industrial, etc.) and the density of uses. A zoning map is part of the zoning ordinance and this map outlines the location of zoning districts in the community. For certain large-scale developments (typically apartment complexes, shopping malls, or industrial buildings) zoning ordinances generally require submittal of a special permit and a site plan. A review of a site plan provides the local agency administering the zoning ordinance with more information about a development which is used to decide whether the development is acceptable.

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[1] Neither of these regulations control the materials or the construction of a building; these are covered by local building codes.

Many large developments involve the creation of new streets (i.e., the subdividing of land). The zoning ordinance does not regulate the design of streets or the installation of infrastructure associated with development. When these matters are involved in new development, the local subidivision ordinance is applied. For many large developments, both the zoning and subdivision ordinances are applied.

Zoning and subdivision controls have been applied for several decades for a variety of reasons. The legal rationale for zoning has traditionally revolved around the local community's ability to use its police power to protect the public's health, safety, and welfare. Added to these basic premises in recent years is a fiscal goal. Faced with developments that may have resulted in greater costs to the community than tax revenues, communities in the 1970's often used their land use regulations as fiscal controls. This trend has resulted in requirements for developer provision of public facilities, such as park dedications and land for future schools. Another aspect of this trend has been an increase in requirements for roads and infrastructure in an attempt to ensure that the private developer totally internalizes the costs of new development.

Accompanying this shift of public infrastructure costs to the private developer has been an infusion of environmental concerns in the development process. Increased consciousness about environmental issues that surfaced in the 1970's has had two impacts on the local land development process: an increase in public regulation over private actions; and an increase in higher-level government intervention in the development process. Both the zoning and subdivision ordinances have been re-tooled significantly in the last ten years to accommodate environmental controls.[1]

These controls have been grafted on to local land use regulation primarily in two ways: 1) through performance standards, and 2) through requirements for an assessment of the project's environmental impacts. Environmental performance standards found in local land use regulations include such diverse items as limits on noise from land use activities, limits on stormwater runoff from the development, limits on parking (as a means for dealing with automobile-related pollutants such as carbon monoxide and hydrocarbons), and limits on the amount of vegetation that can be destroyed in construction. For some of these environmental concerns, communities have developed entire new ordinances, rather than amend their zoning or subdivision ordinances. For example, a developer may have to comply with a shade tree ordinance, an erosion control ordinance and a wetlands ordinance in addition to the basic zoning and subdivision ordinances. Mandates for these changes have come from several sources, including state and federal legislative initiatives, as well as from concerns at the local level itself.

As communities have struggled to control the environmental impacts of development with a phalanx of regulations and ordinances, the state has begun to play a more prominent role in regulating the environmental issues in the housing development process. The intervention of states into land use matters--long a bastion of local control--has not occurred without considerable controversy. The rationale for state intervention is based principally on the notion that a broader perspective is often needed in regulating development. For example, certain "critical areas", such as groundwater aquifers, large-scale wetlands areas, or coastal areas may be located in several communities and are not likely to be protected to the same level of control by separate local regulations. There are also cases where "developments of regional impact" will result in effects across several communities. Regional shopping centers, industrial parks, and recreational areas are examples of development that are likely to produce economic and environmental shockwaves across an entire region. Finally, there may be developments considered to be nuisances, such as landfills, sewage treatment facilities, or low-income housing projects, that provide regional benefits but which require state intervention or incentives in order to be located in a community. As a result of these concerns, states have dramatically increased their involvement in the land development process.

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[1] See, for example, Urban Systems Research and Engineering, Inc. Evaluation of the Use of Existing and Modified Land Use Instruments to Achieve Environmental Quality. Prepared for the Environmental Protection Agency, March, 1979.

In addition to adding a broader perspective to the development process, states have increased their environmental presence in local land use issues as a way of ensuring consistent regulation of common environmental problems. States, for example, have taken the lead in establishing uniform regulations for the design and installation of on-site wastewater disposal systems. More recently, states have begun to develop state enabling legislation in such areas as erosion control, stormwater control, and wetland protection.

The above review represents a quick overview of the type of environmental considerations being introduced into the local housing development process. Several themes emerge:

- even disregarding the influence of Federal statutes and regulations, environmental considerations often play a prominent role in the local development process;
- the number of environmental issues regulated in the local development process is multiplying, which in turn means more participation by local agencies as well as regional and state agencies;
- there has been very little consideration given to integrating environmental regulation in the land use conversion process;
- environmental concerns have been grafted onto existing regulations, developed separately at the local level, or added at a higher level of review.

Before directly considering the implications of these issues for housing costs, a brief review of housing cost components is presented.

2.2 HOUSING COST COMPONENTS

The cost of housing is the summation of a number of costs incurred by the land developer, home builder and resident. In many cases, one company or individual may play more than one of these roles; for example, a land developer may construct apartment buildings as well as prepare the site. However, regardless of who actually bears it, the cost of new housing can be broken into several components, such as those shown in Exhibit 2-1.

The primary focus of this study are the cost components typically incurred by the developer or builder once a site has been obtained. Land costs are affected by environmental regulations which effectively reduce the supply of available land. However, these costs are fixed prior to the development process. The cost of unimproved land is affected by a variety of factors, including:

- accessibility of the land to employment centers and amenities;
- its physical developability in terms of natural features and constraints;
- land use regulation; and
- demands for land for various activities, in terms of population and economic growth.

The most significant of these factors affecting the price of land--demand (as represented by population and economic growth)--is tempered by the other variables listed above. The other factors constrain or enhance the desirability of the land for development. For example, the availability of public sewers or public water increases the developability of land. Similarly, land that is characterized by severe slopes, wetlands, or other natural features may be expensive or physically difficult to develop, and thus more costly.

EXHIBIT 2-1

HOUSING COST COMPONENTS

o Land: the purchase price of "unimproved" land prior to removal of cover, grading or the provision of services; o Land Development: cost of planning, permitting land clearance, installation of utilities and roads, and measures employed to mitigate the environmental impacts of site preparation activities; o Land Development Financing: interest costs on funds borrowed for land purchase and development; o Construction: costs of materials and labor inputs in the construction of dwelling units; o Construction Financing: interest as funds borrowed for construction activities;	Developer and builder costs
o Mortgage Financing and Settlement Costs: interest payments on funds borrowed to purchase completed homes, and changes incurred in the transference of title to real property (these costs are generally unaffected by environmental regulations); o Operating: costs of operating and maintaining a home once construction is completed and the dwelling is occupied; these include energy and repair costs plus user charges for public services.	Homeowner Costs

Land use regulations may affect the cost of land by limiting its supply. There are several ways in which land use regulations affect the supply of land:

- Amount of Land: Land use regulations affect the amount of land "available" for development by the limitations placed on development. For example, large lot zoning may take affected land out of the market for most types of development. Similarly, zoning land for agricultural uses may remove land from development.

- Type of Land: Regulations, particularly those with environmental considerations, affect which type of land is in the land development market.

- Location of Land: Regulations, particularly those geared to yearly quotas or availability of public services, may affect land available for development.

- Timing: Land use regulations may be used to limit the supply of land available for development at any one time. Communities consciously pursuing a "staged development" approach will use investments in public facilities to supplement land use controls.

Land development costs, as shown in Exhibit 2-1 consist of both administrative costs, such as permit fees and engineering studies, and costs associated with compliance with regulations. As discussed below in Section 2.3, land development costs are a primary focus of this study because of their direct link to environmental regulations. A developer will typically face two types of financing costs in the development process--land development financing and construction financing. These costs are subject to the base amount borrowed (the cost of the land and of the construction materials and labor) and prevailing market interest rates. These financing costs are typically referred to as the "carrying costs" of development. Carrying costs are, of course, affected by the length of the development process. Consequently, regulations that affect the length of the development process will tend to increase a developer's carrying costs.

Finally, construction costs comprise the last component of the developer's housing costs. House construction costs for the purposes of this study consist of the materials and labor required to build a house. Construction costs are the largest component of the cost of a house. These costs typically run to 60-75% of the total cost of a house. See, for example, Exhibit 2-2. As seen in this breakdown, the primary components influenced by environmental regulations--land development costs and carrying costs--represent a relatively small portion of the cost of a house (in the above case, they represent 21.8% of the housing cost).

Environmental regulations can directly affect these components of housing costs in three ways. First, the regulations can require the developer to study the proposed site, to identify impacts,and to develop mitigation measures for environmental problems. These costs are incurred while the project is reviewed by permitting agencies, and costs can increase when changes to project plans are required. This first type of cost is administrative in nature, and affects the planning expenditures which are part of the land development cost component shown in Exhibit 2-1.

The second area of impact concerns carrying costs. These are related to administrative costs, and are incurred as environmental regulations increase the time required for the developer to obtain the necessary approvals. Delays in the development process affect primarily costs incurred in financing land development, directly through property taxes and insurance paid during the period in which environmental problems are settled. If the delay period is sufficiently long, then the developer can also incur indirect carrying costs as the prices of building materials and labor rise with inflation. The costs of construction financing may also be affected if environmental requirements stop or slow a project for which ground has been broken.

EXHIBIT 2-2

TYPICAL HOUSING COST COMPONENTS

Component	Cost	%
o Land	$4,000	5.7%
o Land Development		
- Bond & Permit Fees	2,200	3.1
- Improvements	7,000	10.0
o Carrying Costs		
- Land financing	2,000	2.9
- Construction financing	4,000	5.8
o House Construction		
- Materials & Labor	47,000	68.1
- Miscellaneous other costs	3,000	4.3
TOTAL	$69,200	100.0

SOURCE: Seidel, op. cit.

The third area of impact lies in the costs associated with compliance with mitigation requirements of environmental regulations. This type of cost includes the construction of additional sewerge capacity or the cost of fill in a floodplain area. In the case of projects which must be reduced in scale because of environmental problems, these costs represent the loss to the project of the portion of the plan that could not be built. In terms of the cost typology presented in Exhibit 2-1, these compliance costs affect land development activities (e.g., construction of roads and other site improvements) as well as changes in the amount of building materials and labor required for the construction of the houses themselves.

Environmental regulations also have an indirect impact upon the costs of housing, through pollution control requirements imposed upon manufacturers of materials used in construction. These indirect or input costs represent a fourth category of impact. This category represents the costs of pollution abatement equipment that is included in materials prices paid by the developer.

Several other types of costs are also affected by environmental requirements. These include regulations which effectively limit the amount of land available for housing development in a community, and requirements which affect the costs of operating and maintaining the housing unit once it is completed. This study will not attempt to detail the specific impact of these costs, since land prices are influenced by many factors other than the absolute supply, and operations and maintenance costs are borne by the housing consumer (homeowner or renter) rather than by the developer.

2.3 DIRECT DEVELOPMENT COSTS: REVIEW OF THE LITERATURE

While both direct and indirect housing cost impacts are important, the literature largely concentrates upon the direct impacts of environmental regulations. Indirect impacts, while acknowledged to be significant, have yet to be systematically analyzed in the context of the residential development process. In terms of direct costs, the literature is most fruitful in dealing with development process costs. It is these costs that are discussed in this section.

To organize the review of the literature, direct development costs are subdivided into the three types of costs presented above:

- o Administrative costs.
- o Carrying costs, and
- o Compliance costs.

Each of these costs is discussed below.

Administrative Costs

As briefly mentioned in Section 2.1, local governments are gradually increasing administrative costs in the development process. Administrative costs are costs borne by the developer in terms of fees and studies that are required to obtain necessary permits and approvals. Fees range from those for site plan engineering and water and sewer hook-up to building permit and other construction-related administrative assessments (see Exhibit 2-3). This fraction of housing costs has been observed to be increasing. A recent survey of housing prices in Orange County, California, for example, found that fees increased relative to overall housing prices between 1975 and 1979,[1] continuing the trend observed in other parts of the country prior to 1975.[2]

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[1] Alfred Gobar Associates, Housing Cost Analysis: Orange County. Prepared for Californians for an Environmental of Excellence, Full Employment,and a Strong Economy through Planned Development (CREED), Brea, California, 1980. p. 38.

[2] Urban Land Institute and Gruen, Gruen & Associates, Effects of Regulation on Housing Costs: Two Case Studies. Washington: Urban Land Institute, 1977, pp. 17 and 29.

EXHIBIT 2-3

PER UNIT FEE SCHEDULE FOR SINGLE FAMILY DETACHED HOUSES IN ORANGE COUNTY, CALIFORNIA[1]

Cities	Tentative Tract Map	Engineering & Grading[2]	EIR	Sewer	Park In-Lieu	Building Permit	Plan Check	Plumbing	Electrical	Flood & Drainage	Total
Anaheim	$5.00	$150.00	$ .50	$220.00	$300.00	157.00	$78.50	$35.00	$30.00	$70.00*	$1,046.00
Brea	2.00	150.00	6.00*	220.00	300.00	157.00	78.50	40.00	35.00	200.00*	1,188.50
Buena Park	.50	150.00	-0-	200.00	-0-	157.00	75.50	45.00	32.00	-0-	660.00
Costa Mesa	2.00	150.00	3.00	235.00	338.00	172.00	86.00	35.00	30.00	200.00*	1,251.00
Cypress	2.00	150.00	4.00*	250.00	300.00*	157.00	78.50	35.00	30.00	220.00*	1,226.50
Fountain Valley	.50	150.00	6.50	320.00	400.00	135.00	67.50	40.00	35.00	200.00	1,354.50
Fullerton	2.00	300.00*	7.00	220.00*	350.00	157.00	78.50	40.00	35.00	100.00*	1,289.50
Garden Grove	.50	150.00	-0-	220.00	325.00	157.00	78.50	40.00	35.00	100.00	1,106.00
Huntington Beach	5.00	150.00	1.04	60.00	350.00*	135.00	67.50	40.00	35.00	400.00*	1,243.54
Irvine	2.00	150.00	6.00	200.00	300.00*	157.00	78.50	40.00	35.00	200.00	1,168.50
La Habra	4.00	150.00	5.00	250.00	300.00*	157.00	78.50	40.00	30.00	-0-	1,014.50
Laguna Beach	2.50	150.00	7.00	225.00	400.00*	157.00	78.50	45.00	40.00	1,000.00*	2,105.00
La Palma	1.50	150.00	1.00	40.00	400.00*	126.50	63.25	40.00	35.00	**	857.25
Los Alamitos	6.00	150.00	1.50	400.00	-0-	135.00	67.50	40.00	35.00	400.00*	1,235.00
Newport Beach	6.00	150.00	7.00	220.00*	400.00	157.00	78.50	45.00	35.00	***	1,098.50+
Orange	2.50	150.00	3.50	300.00	250.00	157.00	78.50	40.00	35.00	90.00*	1,106.50
Placentia	4.00	150.00	6.50	100.00	405.00*	152.00	96.50	45.00	35.00	40.00*	1,034.00
San Clemente	1.00	150.00	6.00	275.00	500.00*	157.00	78.50	40.00	35.00	225.00*	1,467.50
San Juan Capistrano	1.00	150.00	5.00	325.00*	200.00	157.00	78.50	40.00	35.00	320.00*	1,311.50
Santa Ana	1.00	150.00	2.00	150.00	340.00	170.00	85.00	40.00	35.00	150.00	1,123.00
Seal Beach	1.50	150.00	6.00	100.00	327.00	157.00	78.50	40.00	35.00	-0-	895.00
Stanton	2.00	150.00	4.00	200.00	-0-	126.00	63.25	35.00	30.00	-0-	610.25
Tustin	1.50	150.00	5.00	620.00*	500.00*	135.00	67.50	40.00	35.00	-0-	1,554.00
Villa Park	2.00	150.00	7.00	854.00*	-0-	157.00	78.50	45.00	35.00	-0-	1,328.50
Westminster	1.00	150.00	1.00	250.00	785.00	157.00	78.50	40.00	35.00	300.00*	1,797.50
Yorba Linda	4.00	150.00	8.50	220.00*	200.00*	157.00	78.50	40.00	35.00	320.00*	1,213.00
AVERAGE	2.42	150.00	4.23	259.69	306.54	152.13	76.75	40.19	34.12	174.42	1,203.27+
Unincorporated County Area	6.00	150.00	4.00	200.00*	300.00*	157.00	78.50	40.00	35.00	300.00*	1,270.50

* Based on minimum fee

** Included in park in-lieu fee

*** Negotiated

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[1] Estimates assume a 50-unit development of $40,000 houses on 1,500 square foot lots with 5 units per acre.

[2] $4,500 per lot assumed average improvement cost (grading, streets, curbs, gutters, sidewalks, sewers, etc).

Source: California State College at Fullerton, School of Business Administration, 1975, as reported by Fred E. Case, "The Impact of Land Use and Environmental Controls on Housing Costs," in The Cost of Housing, Proceedings of the Third Annual Conference, San Francisco, California, 1977, p. 141-176.

In addition to costs associated with community-initiated goals, over the past decade a variety of new regulations have been promulgated which have imposed additional administrative costs upon developers. While some of these additional requirements have been imposed at the local level, perhaps the most significant new regulations upon the housing industry have originated from Federal and state levels of government. The most conspicuous have been the regulatory procedures required for Environment Impact Statements (EIS) and for the Federal Coastal Zone Management (CZM) program.

Environmental impact review requirements for residential developments originate in the Federal National Environmental Policy Act (NEPA) of 1969. While the Act applies only to Federal projects or legislation, it has served as a model for similar legislation at state and local levels. Currently, 28 states have either comprehensive or limited EIS requirements.[1] EISs are increasingly being required by local governments as well, even in non-EIS states.[2] Seidel reports that of 400 homebuilders sampled in a 1976 survey, 40 percent of those active in EIS states were required to file EISs on more than 50 percent of their projects; in non-EIS states, 13 percent were required to do the same.[3]

Administrative costs are of two kinds in the EIS review process. The cost of preparing the EIS is the more significant cost element and is usually borne by the developer, since this responsibility lies there. Preparation costs depend upon the size of the project, the environmental background upon which the project is to be imposed, political factors and the scope of review administered by public officials. Since thresholds which trigger EIS preparation and review differ among Federal agencies and states, total preparation costs vary significantly and are difficult to compare. EIS review procedures in Florida, for example, are invoked when developments of more than 3,000 residential units are planned for urban counties or 500 units are planned for rural counties.[1] Criteria for review are less specific in California, but developments consisting of a minimum of 100 to 300 units are usually subject to EIS review.[2.] Case studies in the two states revealed preparation costs ranging from $50,000 to $200,000 in Florida (about $30 per unit) and $4,000 to $10,000 in California ($17 to $25 per unit).[3]

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[1] Council on Environmental Quality, Environmental Quality - 1979. Washington DC: Executive Office of the President, 1980, p. 595.

[2] Stephen R. Seidel, Housing Costs and Government Regulations: Confronting the Regulatory Maze. New Brunswick: The Center for Urban Policy Research, 1978. p. 240.

[3] Ibid, p. 240-241.

The second cost element associated with EIS procedures is the cost of public review. These costs are recouped either through fees assessed to the developer or through general taxation revenues. Although the cost of public review has been found to be relatively insignificant on a per unit basis (amounting to two dollars per unit in Florida and six dollars per unit in California)[4], a recent review of the California Environmental Quality Act has estimated that costs may be high: of the $19 million spent on document preparation, review and administration for private projects, $9 million was borne by taxpayers.[5]

Other comprehensive assessments of a project's environmental impacts may be required by coastal zone management authorities. These reviews are only required of developments located within the coastal zone, as defined by this management authority. In most cases, this authority is divided between a designated state agency and local agencies already involved in land use regulation.[1] These agencies may accept the findings of the Federal or state impact review processes, or a separate assessment may be required which focuses specifically on the coastal zone.

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[1] Franklin J. James and Thomas Muller, "Environmental Impact Evaluation, Land Use Planning, and the Housing Consumer," AREUEA Journal, Vol. 5, 1977, p. 283.

[2.] Ibid, p. 284.

[3] Ibid.

[4] Ibid, p. 285.

[5] Seidel, op. cit., p. 248.

Cost impacts of coastal zone management have perhaps been studied most extensively in the context of New Jersey's coastal program. Richardson found that regulatory costs associated with the processing of permits for the state's Coastal Areas Facilities Review Act (CAFRA) amounted to $50 per unit for single family and $33 per unit for multifamily developments.[2] These costs, at the time of the survey (1973 to 1975) represented three and five percent, respectively, of the total per unit regulatory cost of single and multifamily development projects. Permit costs have since increased with imposition of a CAFRA governmental fee of $500 per project and $10 per unit (up to a maximum of $5,000).[3] These changes have increased administrative costs to $69 for single family and $48 for multifamily developments.[4] Note that these costs do not include those which arise from EIS or other document preparation activities which may accompany CZM provisions. In extreme cases, these latter costs can exceed $250,000.[5] However, the extent to which such additional costs characterize all state CZM programs is expected to be minor.

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[1] Dan K. Richardson, The Cost of Environmental Protection. New Brunswick, New Jersey: Center for Urban Policy Research, 1976, p. 20.

[2] Richardson, op. cit, p. 177.

[3] Personal communication with the New Jersey Department of Environmental Protection, 15 October 1980.

[4] Richardson, op.cit., p. 117.

[5] Case, op.cit., p. 251.

In summary, administrative costs are a small but growing component of housing development costs. The growth in these costs is attributable to increased local requirements as well as requirements initiated at state and Federal levels.

Carrying Costs

While delay costs are gradually being perceived as a major problem in all new developments,[1] there is no formal or consistent definition in the literature of what constitutes "delay" in the development process: while a developer may consider time required for permit reviews to be a delay, the reviewer may point to improvements in project design accomplished in this period. Generally, delay is considered to be the extra time that a project takes to complete because of regulations. Implicit in this definition is some baseline development schedule in a process devoid of regulation. Selecting a baseline development process is obviously problematic, as seen in the case studies presented in Chapters 4 and 5.

That carrying costs have become so significant is attributable to the greater time required to develop residential properties, from land acquisition to final sale of houses. While time estimates vary from location to location, the development times experienced in Houston--one of the fastest growing urban areas in the country--provide one example. Since 1967, the time required to complete residential projects has increased by 25 to 35 percent.[2] While a project required 21.6 months to complete in the period between 1966 and 1969, it took 29.2 months in 1971-73, and 27.4 months to complete in 1974-77. From 1966 to 1969, only nine percent of all developments surveyed took more than 29 months to complete. From 1971 to 1977, in contrast, 37 percent took longer. Though partly attributable to early planning activities and longer construction schedules, the study found that the most significant increase in development time occured during the permitting stages when most application preparations, approvals and engineering design tasks were performed.[1]

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[1] Pat Choate, As Time Goes By: The Costs and Consequences of Delay. Columbus, Ohio: The Academy for Contemporary Problems, 1980.

[2] Urban Land Institute and Rice Center, The Cost of delay Due to Government Regulation in the Houston Housing Market. Washington: Urban Land Institute, 1979, p. 36-37.

The increased time required to develop residential projects has resulted from several factors. Among the most prominent are:

- the increasing number of new and amended regulations that govern residential development;
- lack of data which are needed for certain permit applications;
- more preparation and paperwork in the applications process to conform with increased submission requirements;
- extended periods for review and approval by public agencies;
- overlapping jurisdictions which cause repetitive and uncoordinated review procedures; and
- non-compliance with permit procedures by the developer.

In addition, examples have been offered where vaguely worded regulations have led to contradictory interpretations by different levels of government, extending the review process considerably.[2] Both Frieden and Rhyne have suggested that review procedures are often purposely delayed by government agencies to achieve political or other goals.[3]

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[1] Ibid, p. 42.

[2] Beth Rhyne, "Regulations and the Cost of a House in Massachusetts', prepared for the Massachusetts Executive Office of Communities and Development, Boston, Massachusetts, May, 1979.

[3] Bernard J. Frieden, The Environmental Protection Hustle. Cambridge,MA: MIT Press, 1979; and Rhyne, op. cit.

The problem of attributing carrying costs to environmental regulations is exacerbated by the number and types of controls that usually apply simultaneously during the development process. Seidel has distinguished four major types of controls--zoning ordinances, environmental controls, growth controls and subdivision regulations --that contribute to development time.[1] An example of how such controls interact and overlap in the development process can be seen in specific regulations that apply for subdivision approval and construction in the State of Colorado (Exhibit 2-4). Clearly, coordination among government agencies and the developer is required if total review time is to be minimized, an exchange that is not always possible.

Housing costs associated with the length of the development process stem from several sources. These include:[2]

- land holding costs
- inflation
- overhead
- foregone revenues (opportunity costs)

Land holding costs consist of expenses incurred when the developer's funds are kept in the form of land holdings.[3] Expenses usually consist of interest charges on borrowed capital, property taxes and insurance and maintenance charges. Inflationary costs result from the postponement of materials and labor purchases until the review process for that phase of the project is complete. During inflationary periods, price and wage increases can be substantial after lengthy regulatory delays, adding significantly to project costs. Overhead costs are fixed costs incurred by the developer

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[1] Seidel, op. cit., p. 319.

[2] Construction Industry Research Board, Cost of Delay Prior to Construction. Los Angeles, April 1975, p.4; Seidel, op.cit., p. 249.

[3] Ibid, p. 4.

SOURCES OF DELAY IN THE REGULATORY PROCESS IN COLORADO

Jurisdiction	Process	Time Required
Federal		
FHA VA		
1. Mortgage insurance	Plans for development must be approved. Appraisal of units is required.	FHA 6-9 months VA 3 months
2. EIS	In subdivisions over 500 lots, EIS must be submitted in draft form, reviewed, revised and resubmitted as final.	1 year minimum
State		
Water quality	Effluent discharge permit required.	180 days minimum
Air quality		
Indirect source	Process is still under consideration.	1 year monitoring
Fugitive dust	Process is controlled at the county level.	
Colorado Occupational Safety and Health	Continual compliance with safety and health requirements during construction.	Concurrent with construction.
Regional	Conflict with regional master plan can result in request for planning commission rejection.	Indeterminant
County or City		
Zoning and/or annexation	Submit plan. Post property. Planning commission review and hearing -- possible revisions and resubmittal, county commissioners hearing and decision. Sketch plan submitted and reviewed.	3 months to 2 years
Subdivision	Preliminary plat submitted. Public hearing. Final filing approved by planning department staff.	1 week to 1 month (if applicable)
Building permit	Compliance with building department requirements.	1 day to 30 days
Inspection	In process inspection of sitework pours, electric, heating, plumbing.	Same day to one week or more.
Water quality	Approval of sewer contingent on demonstration of effluent disposition and quality.	Weeks or months.
Air quality		
Indirect source Fugitive Dust Burning	Standards will be set at state level and administered locally.	Delay occurs during non-compliance.

SOURCE: James R. Lincoln, Dean C. Coddington & John R. Penberthy, An Analysis of the Impact of State and Local Government Intervention on the Homebuilding Process in Colorado, 1970-75. Prepared for the Colorado Association for Housing and Building by Bickert, Brown, Coddington & Associates, Inc. Denver, Colorado, April 1976, p. 6.

to maintain the day-to-day operations of the enterprise. They comprise elements such as rent, utilities, insurance, salaries and other expenses. As these costs are not directly associated with any given development, they are typically apportioned to each active project, usually as a function of project duration.[1] Thus, projects of longer duration incur proportionately greater overhead costs.

Opportunity costs are the most difficult to quantify. They are the potential revenues that are foregone by the developer in committing funds to a given project. Though the decision to invest in that project was presumably based upon a profit maximizing motive, a delay can alter the relative profitability of alternative ventures, resulting in lost revenue and lower returns on capital than originally envisioned. These foregone revenues may be forever lost to the developer or may be made up through higher profit margins on the delayed project.

The Construction Industry Research Board (CIRB) has estimated the annual expenditures for each category of carrying cost (except opportunity costs) relative to project price for developments in the State of California (Exhibit 2-5). If these estimates are reliable, then a one-year increase in development time for a project consisting originally of $30,000 homes could add from $4,110 to $6,360 to the sales price of each unit.[2]

Whether these cost estimates are valid is still open to question, however. Although not directly comparable, a study of delay costs in the Houston housing market[3] suggests that preconstruction carrying costs are substantially less than those estimated by CIRB (See Exhibit 2-6). Whether the differences are attributable to the characteristics of the two housing markets or other factors cannot be determined from these data.

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[1] *Ibid*, p. 9.

[2] *Ibid*, p. 15.

[3] Urban Land Institute and Rice Center, *op. cit*.

EXHIBIT 2-5

COST OF DELAY AS A PERCENTAGE OF UNIT SALES PRICE AS ESTIMATED BY CIRB[1]

	Land Holding Costs	Inflation	Overhead	Combined
Residential - Single Family	1.2 - 2.2	6.5 - 13.0	6.0	13.7 - 21.2
Residential - Multi-Family	1.2 - 2.2	6.4 - 12.9	6.0	13.6 - 21.1

[1] Percentage cost of one year delay.

Source: Construction Industry Research Board, op.cit., p. 14.

EXHIBIT 2-6

CARRYING COSTS PER MONTH OF DEVELOPMENT TIME IN THE HOUSTON HOUSING MARKET

(per unit)

COST COMPONENT	Project Phase	
	Early Planning Activities	Plan Preparation and Review
Land Holding Costs	--	\$12.01 - \$15.44
Inflation[1]	\$324.52 - \$336.35	\$324.99 - \$338.05
Overhead	\$33.26 - \$48.72	\$37.10 - \$57.04
Foregone Revenues	\$0.14 - \$0.20	\$1.45 - \$1.80

[1] Inflation Cost = Inflation (Lot Construction) + Inflation (Materials and Wages).

Source: Adapted from Urban Land Institute and Rice Center, _op.cit._, p. 29-30.

Empirical evidence is far from achieving a consensus about the impacts of carrying costs. Where compatibility exists, cost estimates have been derived for a given regulation rather than for the overall regulatory process, from project conception to completion. As with administrative cost data, delay cost estimates associated with EIS and CZM regulations are documented best.

Regulatory delay in the EIS review process has been noted in all studies examining EIS regultions, and estimates of delay are fairly consistent. CIRB, for example, found EIS requirements to add slightly more than three months to project completion time in California in 1974.[1] James and Muller found EIS review procedures to delay projects by an average of two months in California (San Diego County) and six months in Florida[2] (The longer review times in Florida were attributed to the larger project sizes that typically were reviewed there).

But while time estimates are reasonably consistent, dollar estimates differ greatly in these studies. CIRB, for example, estimated that an average delay of 3.2 months in California added 3.6 to 6.8 percent to the selling price of a home.[3] On the other hand, even in Florida, where EIS procedures usually delayed projects by half a year, delay costs amounted only to $160 per unit.

A major characteristic of delay in EIS preparation and review is the extreme variation in times required to complete the process. Extensive delays are not uncommon in most case histories of residential developments which have undergone EIS review.[4] One reason for this variation is that delay is dependent upon the stage of the review process at which the EIS is required.[1] If EIS submission is coordinated with other state and local permitting procedures, delay costs can be minimized. If, on the other hand, the EIS is submitted after most other approvals have been obtained, delay costs can be significant. To overcome this problem of coordination, at least one study has suggested the integration of EIS report preparation into the developer's own planning process, using the EIS as a planning and appraisal tool.[2] In this way, delay could be reduced substantially, Despite the advantages of such an approach, there is little evidence that developers have attempted to utilize the EIS in this fashion.

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[1] Seidel, op. cit., p. 249.

[2] James and Muller, op. cit., p. 285.

[3] Construction Industry Research Board, op. cit.

[4] See for example, James and Muller, op. cit., p. 285.

Coastal Zone Management programs can also be sources of delay in the residential development process. From the small amount of evidence available, CZM review has been estimated to add approximately three months to the review process, increasing unit costs by about $230, or adding between $1350 and $1850 to the sales price of a home.[3]

Richardson's comprehensive study of coastal protection costs of New Jersey's plan (CAFRA) reveals similar delays, though lower associated costs.[4] While subdivision processes outside the coastal zone took 22 months in 1975, those under CAFRA jurisdiction took 24 months,an average delay of two months. Associated delay costs, however, amounted only to $85 per single family and $92 per multifamily dwelling, substantially less than costs reported in the previous study.

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[1] Seidel, op. cit., p. 249.

[2] Bernard B. Levine and David L. Colgan, "The Effect of Environmental Impact Statements on the Real Estate Investment Trust Industry, Urban Lawyer, 1974.

[3] See Case, op. cit., p. 255.

[4] Richardson, op. cit.

As with EIS review, the major determinant of delay in the CZM review process is the timing of state review relative to traditional subdivision and site plan reviews done at the local level. Richardson[1] has found that state CZM reviews (in New Jersey) cause the least delay when they occur before or along with local review (Exhibit 2-7). Whether provisions exist in all state CZM programs to allow for flexibility in scheduling the state review process has not been reported in the literature.

Although, as homebuilders claim, the proliferation of regulations governing the housing industry has increased development times, at least one study has found that delays are most notable where many changes or additions to government regulations are occurring.[2] A case in point concerns the impacts associated with the National Flood Insurance Act on residential projects in the Houston area. Over the 1971-73 period, projects located in designated floodplains took 37 months to complete, fully nine months longer than comparable projects that are not located in floodplains. Investigation revealed, however, that delay resulted not from the permitting process, but from the uncertainty associated with the development of initial Flood Hazard Boundary Maps.[3]

As the early 1970s marked a period when a substantial number of environmental regulations were introduced by all levels of government, it is possible that similar learning curve effects have accompanied the continued application of these regulations to the residential development process, shortening their review times considerably. However, with ever more regulations being introduced, such effects are likely being masked or cancelled out by the increasingly complex regulatory structure overseeing residential development.

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[1] Richardson, op. cit.

[2] Urban Land Institute and Rice Center, op. cit., p. 42.

[3] Ibid, p.57.

EXHIBIT 2-7

EFFECT OF STATE INTERVENTION ON REGULATORY DELAY IN THE COASTAL ZONE

Time of State Intervention in Relation to Local Process	Delay Attributable to State Intervention (months)		Delay Costs Attributable to State Intervention (per unit)	
	Single Family Development	Multi-Family Development	Single Family Development	Multi-Family Development
No state intervention	--	--	--	--
Following preliminary plat submission (S.F.)	1		$86	
Following site plan submission (M.F.)		4		$92
Following preliminary plat approval (S.F.)	8		$238	
Following site plan approval (M.F.)		7		$155
Following final plat approval (S.F.)	11		$486	
Following site local approvals (M.F.)		9		$208

Source: Seidel, op.cit., p. 256.

To summarize, carrying costs have been found in most studies to be the major source of regulatory cost increases in the residential development process over the past decade. While evident in both the planning and construction stages of development, delay has been found to result mainly from regulatory lag during the permitting and plan review stage. Costs stemming from land holding activities, inflation, overhead and foregone revenues have been estimated to constitute a few percent of the purchase price of a new home.

Compliance Costs

Compliance costs involve attempts to mitigate potential environmental impacts associated with development. For the purposes of this discussion compliance and mitigation are used interchangeably. Compliance actions are requirements imposed by environmental regulations. These requirements have been cited by the homebuilding industry both for inflating housing prices[1] and for inducing extreme variability in housing prices among regions.[2]

Mitigation or compliance requirements range from physical changes in the environment to land dedications; in the extreme, they can result in project cancellation. And although mitigation of environmental impacts has usually been associated with major environmental review processes of higher-level agencies, such as EIS and CZM procedures, it has been used increasingly by local governments as well.[3]

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[1] Case, op cit., p. 156.

[2] "NAHB Multi-State Survey of Development Costs: Regulation Price Tab Varies from $2961 to $6841 per Lot," Professional Builder, March, 1976.

[3] While local governments have traditionally exercised authority to require plan changes for public health and/or welfare reasons as part of standard subdivision review processes, changes specifically targeted at environmental problems have been required since the early 1970's.

There are basically two types of mitigation measures: those that attempt to alter or prevent an environment impact; and those that allow the impact to occur and attempt to decrease its magnitude. These two types of mitigation measures are referred to as impact prevention measures and impact management measures. Examples of impact prevention measures include reductions in the scope of a development (e.g. fewer houses) or changes in the location of part of the development (e.g. avoid a sensitive wetlands area). Impact management measures represent additional measures or activities to deal with expected impacts. The use of impact management measures is particularly suitable to those situations where impact prevention measures would in turn create impacts. Consider, for example, the issue of stormwater runoff from a proposed development. If the community has a regulation limiting the amount of runoff from a new development, the developer has several options for complying with the requirement. One impact prevention approach may involve reducing the amount of development. An impact management approach, on the other hand, may maintain the developer's intended density by the construction of stormwater detention ponds to meet the requirement.

Note that the developer incurs compliance costs in both cases. Even though no money is spent on stormwater controls in the impact prevention case, the revenue lost by reducing development density represents a compliance cost.

At the local level, mitigation costs associated with the control of fugitive dust and the protection of wetlands have been documented. In the former case, fugitive dust control during site preparation in Colorado was found to add $27 per lot; control during construction was expected to further add to per unit costs.[1] Mitigation requirements associated with wetlands protection in Massachusetts involved excising of lots from the site plan and grading to redirect water flow in one case study, and excising lots, construction of a retention pond and installation of roof drainage systems on all houses in the second case. As a result, compliance costs amounted to $3,200 to $4,200 per lot in the first case, and $2,750 to $3,050 per lot in the second.[1]

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[1] Lincoln, et. al., op. cit., p.4.

The extent to which mitigation requirements pervade the EIS process has been documented by Seidel.[2] Of developers who were surveyed and who were required to file EIS's for their projects, only 11 percent made no changes to their plans either before or after the review process. On the other hand, 16 percent made changes in their plans prior to the process and 31 percent did so after EIS review. More significantly, over 42 percent changed their plans both before and after EIS review.

Limited evidence indicates similar experience with the CZM review process.[3] In the first eight months of coastal zone management in California, more than 45 percent of residential permits issued in the southern part of the state and 65 percent of thos issued in the northern part had at least one condition attached. Final reviews before the State Commission resulted in conditions being attached to 90 percent of all permits.

The types of changes that are required to clear the environmental review process typically relate to the density of housing, to open space, or to infrastructure. One study, for example, found that nearly 60 percent of developers who changed their plans after EIS review were required to reduce dwelling unit densities.[4] In addition, nearly 55 percent were required to relocate dwellings on their lots. Other changes to plans included dedicating additional recreation areas or open space, building additional sewage handling capacity and project termination or relocation (see Exhibit 2-8). These findings are reinforced by those of another study.[1] Although a number of conditions were imposed by review agencies involved in Florida's EIS process, the three major categories of changes were the dedication of land for public facilities and open space, construction of facilities and reductions in dwelling unit densities. Mitigation costs were estimated in this study to amount to $194 per unit in Florida and $50 per unit in California.

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[1] Rhyne, op. cit.

[2] Seidel, op. cit., p.242.

[3] Case, op. cit., p. 242.

[4] Seidel, op. cit., p.242.

Compliance costs have been found to stem from conditions imposed by agencies at all levels of government, although they are perhaps most commonly associated with Federal and state EIS and CZM review procedures. Though usually referring to design changes to the physical layout of the proposed development, mitigation activities have occasionally involved project cancellation or relocation where impacts have been determined to be too severe to economically reconcile project plans with the development's environmental background.

Because mitigation measures are so dependent upon the local environment, their associated costs are least generalizable to a broader context. As the Massachusetts case studies cited earlier show, mitigation costs can be significant. Large scale developments requiring extensive mitigation activities are likely to incur smaller per unit costs than smaller developments, although this conjecture has not been borne out definitely in empirical studies.

EIS and CZM review procedures have been found to attach mitigation conditions to the issuance of permits. These conditions also typically concern reductions in dwelling unit densities or additions to open space or infrastructure. Limited evidence indicates that mitigation costs associated with these conditions have usually not exceeded $200 per unit. However, as data are scarce, these estimates can only be considered tentative at best.

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[1] James and Muller, op. cit., pp. 290-293.

EXHIBIT 2-8

CHANGES REQUIRED BY EIS REVIEW

Changes	Number of Developers	Percent[1]
Reduction in Dwelling Unit Densities	44	59.5
Relocation of Structures in Lot	40	54.1
Additional Recreation or Open Space	35	47.9
Additional Sewerage Handling Capacity	22	31.0
Relocation or Termination of Project	3	4.1

[1] Does not add to 100 percent because of multiple responses.

Source: Seidel, op.cit., p. 243.

2.4 SUMMARY

This chapter has reviewed studies examining the extent to which environmental regulations have affected housing costs. By considering three types of costs incurred by developers--administrative costs, carrying costs, and the costs associated with compliance or mitigation, the review has found that consistent estimates are not generally available on a comprehensive basis. Most work in this field has been undertaken on a case study basis, where data is applicable only to site specific contexts. By far, the most comprehensive analyses are those that have been performed on EIS and CZM legislation. But, even here, little consensus among studies exists. In fact, these programs do not affect much of the housing being built in this country today: for example, the size thresholds established for EIS review are sufficiently large as to exempt many developments, particularly in those parts of the country in which large housing projects are not common. Obviously, the CZM program does not apply in areas which are not part of a coastal zone. This brief survey of the literature points out that additional research is needed to understand in more detail the cost impacts of environmental regulations upon the new housing market.

The present study is one such attempt to improve this data base. However, its focus is somewhat more specific than most of the studies reviewed in this chapter, as it attempts to determine the extent to which Federal environmental regulations impact housing costs. The following chapter presents the set of Federal environmental laws and regulations that can potentially affect housing development within the framework of the cost typology developed above. The impact of these laws and regulations are then tested in the case studies presented in Section II of this report.

CHAPTER 3

FEDERAL ENVIRONMENTAL REGULATIONS AND THEIR POTENTIAL RELATIONSHIPS TO HOUSING COSTS

This chapter examines several major federal environmental laws in terms of their links to housing costs. The chapter focuses on the principal regulations that have evolved from the following major federal laws:

- Safe Drinking Water Act
- Resource Conservation and Recovery Act
- Clean Water Act
- Clean Air Act
- Noise Control Act
- National Flood Insurance Act
- National Environmental Policy Act
- Coastal Zone Management Act.

Each piece of legislation is first summarized briefly before its links to housing costs are determined and the implementation status of relevant regulations established.

3.1 SAFE DRINKING WATER ACT

The Safe Drinking Water Act (SDWA) of 1974 directs the Environmental Protection Agency (EPA) to establish national primary drinking water regulations applicable to all drinking water systems with at least fifteen service connections or systems regularly serving at least 25 persons. The regulations set maximum contaminant levels (MCLs) for substances found to have adverse effects on public health and describe requirements for monitoring, testing, and public notification of violations. States may exercise primary enforcement responsibility for drinking water, subject to meeting EPA's minimum requirements for program coverage.

The Act also authorizes EPA to designate an aquifer which is an area's sole or principal drinking water source for aquifer recharge protection. Within such an area, no federal financial assistance can be given to any project which EPA determines may contaminate the aquifer and present significant hazards to public health. The definition of financial assistance includes grants and loan guarantees, but does not cover loans from banks receiving general federal assistance unrelated to a specific project.

Link to Housing Costs

The SDWA regulations affect housing costs through the homeowner costs that help pay for the operation of public water supplies. All public water systems will incur some costs in complying with the Act's monitoring and analysis requirements. In addition, those supplies with consistent violations of MCLs will be required to upgrade treatment or find higher quality supplies. Preliminary data from the Water Utility Financing Study[1] prepared for EPA's office of Drinking Water indicate that as many as 11,000 systems will have to take some new action to meet the MCLs. Compliance costs are anticipated to range from $200 per household per year in small systems to negligible amounts in large cities. In over 90% of the systems, costs are expected to be less than $100 per household per year. These compliance costs will be transmitted to home operating costs principally through user charges.

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[1] Temple, Barker, Sloane, Inc., Water Utility Financing Study. Prepared for the Offic of Drinking Water, U.S. Environmental Protection Agency, Washington, D.C., 1980.

In sole source aquifer recharge areas, the effect of SDWA regulations in housing costs can vary. The principal housing cost triggers are the delays associated with EPA review and compliance costs that may result from EIS requirements. For housing projects, these delay and compliance costs may affect the developer's land development and financing costs. For public works projects that are used by homeowners, such as wastewater treatment systems, delay and compliance costs would affect the overall cost of the project. This additional cost would be reflected in homeowner operating costs through higher taxes or assessments.

Implementation Status

EPA's monitoring, testing and notice requirements, as well as most of the MCL standards, became effective in June, 1977. Trihalomethane MCLs will become effective in 1981 and 1983 for large and small systems respectively. Over 70 states currently have EPA approved programs. Altogether, EPA expects 49 states to have an EPA-approved drinking water management and enforcement programs by 1982.

Sole source aquifer regulations have been in effect for the Edwards Aquifer near San Antonio (Texas) since November, 1977. Five other designated areas are currently controlled through proposed regulations, with final regulation expected in 1981. These five recharge areas are:

- Biscayne, Florida
- Fresno, California
- Spokane, Washington
- Nassau/Suffolk Counties, New York
- Northern Guam.

The central basin of the Passaic River in New Jersey was added to the designated sole source list in May 1980.

Citations

Legislation--
Safe Drinking Water Act of 1974: PL 93-523

Key Regulations--
40 CFR 141 National Primary Drinking Water Regulations
40 CFR 149 Review of Projects Affecting the Edwards Underground Reservoir

3.2 RESOURCE CONSERVATION AND RECOVERY ACT

The Resource Conservation and Recovery Act (RCRA) directs EPA to devise criteria for classifying solid waste disposal sites as environmentally acceptable and to inventory all sites classified as open dumps. The Act contains no provisions for federal enforcement of its ban on open dumps, but authorizes funding for development and implementation of state solid waste plans to phase out dumps and to manage the transition to sanitary landfills and resource recovery systems. To be grant eligible, the state plan must meet EPA guidelines, which include the site classification criteria and the open dump prohibition.

RCRA also directs EPA to identify criteria for hazardous waste disposal and to develop standards for generators, transporters, and owners and operators of treatment, storage and disposal facilities.

Treatment, storage and disposal operations must have permits to handle hazardous materials. A manifest system must also be installed for tracking hazardous wastes.

Link to Housing Costs

RCRA primarily affects housing costs through its requirements for environmentally acceptable disposal facilities. In communities required to upgrade their disposal facilities, capital expenditures will increase home operating costs through higher property taxes or disposal fees.

Housing construction costs (costs of materials inputs) are expected to be impacted by hazardous waste regulations. Industries likely to be affected include:

- petroleum refineries
- paint manufacturers
- electroplating
- steel
- nonferrous smelting
- textiles.

Implementation Status

EPA's disposal facility classification criteria and state plan guidelines became effective in 1979. States have completed the first year of a five year inventory of open dumps, and are proceeding with the program's second year. In addition, by the end of March 1981, 27 states had submitted completed solid waste management plans to EPA. The remaining states are expected to submit plans over the next year. Since RCRA will be implemented through state programs, housing costs will not be affected until these plans are approved: fifteen states are expected to have approved plans by the end of FY 1981. However, funds for both the open dump inventory and for solid waste management planning have been deleted from EPA's FY 1982 budget, and it is likely that some states will not proceed with developing programs without federal funding. In these states, it is possible that RCRA will then have no effect upon housing costs.

Regulations for hazardous waste were promulgated in 1980 and the program became effective in November 1980. Generators, transporters, and operators involved in the treatment, storage, and disposal of hazardous wastes must notify EPA of their activities by August 19, 1980 and must possess an identification number to operate. By Spring 1981, eighteen states had received interim authorization to operate their programs for hazardous waste disposal programs. Over the next two years most of the rest of the states are expected to receive this authorization as well.

Citations

Legislation--
Resource Conservation and Recovery Act of 1976: PL 89-272 as amended by PL 91-512, PL 93-611, PL 94-580, PL 96-482.

Key Regulations--
40 CFR 241 Guidelines for the Land Disposal of Solid Wastes.
40 CFR 262 Standards Applicable to Generators of Hazardous Waste.
40 CFR 263 Standards Applicable to Transporters of Hazardous Waste.
40 CFR 264 Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities.
40 CFR 265 Interim Status Standards Applicable to Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities.
40 CFR 122, 124 Permits for Treatment, Storage and Disposal of Hazardous Waste.

3.3 THE CLEAN WATER ACT

The Clean Water Act (as amended through 1977) requires the establishment of ambient water quality standards for the nation's surface waters. The Act sets up a planning process for the implementation of these standards using increasingly detailed regional plans to set priorities for the disbursement of grants for the construction of publicly-owned treatment works (POTWs). In addition, all municipal and industrial dischargers are required to obtain National Pollution Discharge Elimination System (NPDES) permits, which reflect, at a minimum, national technology-based standards plus any more restrictive water quality designations for the receiving water body.

Three of the Act's provisions potentially affect the cost of housing:

- Provisions affecting domestic wastewater disposal;
- Provisions affecting non-point (such as stormwater runoff and sediment) pollution sources; and
- Provisions affecting industries that manufacture products used in housing construction and operation.

3.3.1 Provisions Affecting Domestic Wastewater Disposal

Title II of the Act contains the principal provisions affecting the location and scale of new housing development. Section 201 provides for the control of existing municipal effluents through distribution of construction grants for publicly-owned treatment works (POTWs). This section's implementing regulations define eligible treatment works and establish guidelines for determining the most cost-effective facility plan, including the calculation of the amount of reserve capacity eligible for federal funding. Reserve capacity may be affected by a number of environmental considerations. For example, Secton 316 of the Clean Air Act requires coordination between the Clean Air Act and the construction of wastewater treatment facilities. If a review of the treatment plant reserve capacity indicates that population growth will contribute to unacceptable auto-related pollution, then the size or service area of the treatment plant could be cut back. EPA's Construction Grant Program is also affected by the Agency's Agricultural Lands Protection Policy. Section 201 guidelines and regulations discourage extension of collectors and interceptors into prime agricultural land and require consideration of farmland losses in environmental assessments, thereby affecting the availability of developable land.

Link to Housing Costs--

There are two types of POTW situations in which Clean Water Act requirements can affect housing costs: I, where the community is not served by a municipal sewerage system; and, II, where a community system has already been constructed. These situations are summarized in Exhibit 3-1.

EXHIBIT 3-1

DOMESTIC WASTEWATER DISPOSAL: LINK TO HOUSING COSTS

Potential Development Situations	Direct Developer Costs				Other Costs	
	Administrative	Carrying	Compliance	Input	Land	Homeowner Operating
A. New development served by individual on-site systems.	Planning and preliminary engineering costs for individual systems.	Costs carried during review of developer's plans.	Final engineering and construction costs for each system.	No effect	Lot sizes will be affected by local on-site disposal requirements. Larger lots may be required than in communities with a POTW.	Except in communities with maintenance requirements, homeowner pays for maintenance on an as-needed basis.
B. New development served by small-scale centralized systems that collect, dispose, & treat wastewater from more than one house.	Planning and preliminary engineering costs for collection, disposal, & treatment	Costs carried during review of developer's plans; these will generally be greater than situation A because state and/or federal permits may be required.	Final engineering and construction costs collection , centralized disposal (including cost of land), & treatment. Capacity of disposal system will affect density & possibly per unit construction costs.	No effect	Lot sizes will typically not be affected by off-site disposal; thus land prices may be lowerthan in situation A.	Homeowners will pay regular user charges to homeowners association, developer, or a public management agency to operate & maintain the system.
C. Capacity is available in existing system for new development.	Planning & engineering costs for connections to existing system; generally significantly lower than situation A & B.	Costs carried during review of developer's plans; generally significantly lower than situation A and B.	Final engineering and construction costs for individual house connections.	No effect	Greater development density possible than in situation A; therefore, per unit land costs likely to be lower.	Homeowner will pay regular user charges to public management agency to operate and maintain the system.
D. Capacity is insufficient in existing system for new development.						
D-1 Developer builds individual on-site systems.	Same as situation A	Same as situation A	Same as situation A	No effect	Same as situation A	Same as situation A, except new homeowners may also have a portion of their property taxes allocated by community to operate & maintain existing system. However, also may later have to pay to connect to public system.
D-2 Developer builds small-scale centralized systems.	Same as situation B	Same as situation B	Same as situation B	No effect	If viewed as an interim or temporary situation, land prices may be temporarily depressed. Otherwise same as situation B.	Same as B except homeowner also may later have to pay to connect to public system.
D-3 Community declares a moratorium on new construction until public sewerage capacity available.	Developer's costs associated with attempts to get moratorium lifted.	Costs carried during moratorium. May be significant if moratorium extends for several months.	Costs may be eventually greater due to inflation efforts of moratorium.	No effect	Land prices affected by moratorium likely to go down due to inability to develop the land.	No effect

Implementation Status--

EPA's Construction Grants program has obligated approximately $26 billion in some 19,000 grants to communities. Since 1972 about $13 billion has been spent in the program. According to the 1978 Needs Survey published by EPA's Office of Water Programs, $14 billion will be required to upgrade, construct, or expand 10,000 secondary treatment facilities by the year 2000. An additinal $20 billion will be needed for 8800 plants which require better than secondary treatment. Despite the fact that the program faces certain cutbacks in the near future, it remains politically popular and has a large backlog of money in the grants pipeline. Among policies that are seriously being considered to reduce EPA's obligations to the program is one that would eliminate all federal funding of reserve capacity. If implemented, this could have a major impact on new development costs.

3.3.2 Provisions Affecting Non-Point Pollution Sources

In addition to municipal and industrial discharges, there are also pollution sources that generally do not originate at a single point. Rather they occur over a wide land area and are considered non-point in nature. Non-point sources of pollution include:

- Agriculture: cropland, pasture and rangeland, irrigated land, woodland, and feedlots
- Silviculture: growing stock, logging, road building
- Construction: urban development and highway construction
- Mining: surface mining and underground mines
- Waste disposal: landfill and dumps
- Utility maintenance: highway and street stormwater runoff

Under Section 208 of the Clean Water Act, areawide and state water quality management agencies are developing control strategies for these sources.

Link to Housing Costs--

Solutions to erosion from construction sites and stormwater runoff will directly affect housing costs. Construction-related erosion problems may be solved through "best management practices" that communities or state agencies may impose on contractors during the construction process. Typical solutions include:

Source Controls:

- Modification of surface characteristics, such as temporary seeding, mulching, planting; use of jute or other materials
- Modification of topography, such as slope modification, contour furrowing, and terracing
- Modification of runoff by the use of diversion dikes or small on-site basins
- Staged development to minimize soil exposure in wet-weather months
- Construction activity restrictions to minimize removal of vegetation or proximity to critical areas (steep slopes, water bodies, etc.)

Discharge Controls:

- Off-site detention basins
- Sediment filters or traps
- Land set aside as buffer vegetation

Implementation of these controls will add to the land development costs of new housing.

The control of stormwater runoff also occurs through "best management practices" imposed by state or local agencies on housing developers. For new development, the principal goal of stormwater controls is to reduce the amount and the velocity of stormwater runoff. When used as a preventive method in new construction, a site plan and grading plan are normally prepared to guide the overall development of the site. The strategy may involve minimizing the amount of impervious surface in a particular site, or detention ponds may be incorporated into the site plan. At the extreme, this strategy may involve reducing the density of development. By minimizing impervious surfaces and maintaining as much natural vegetation as possible, more stormwater infiltrates into the groundwater on-site and stormwater runoff is reduced. The extent to which stormwater runoff controls add to land development costs is dependent on individual site characteristics. Detention ponds and density losses represent increased per unit housing costs, but these costs may be offset for the developer by the reduction in costs associated with conventional stormwater drainage facilities.[1]

Implementation Status--

Implementation of non-point source controls through Section 208 plans is difficult to trace. As of July 1979, 192 areawide plans had been certified by state governors and 75 approved by EPA. Funding in the program is being phased out in FY 1981. Although 208 plans did not require communities to implement plans, the 208 planning process has been responsible for raising local awareness of non-point pollution problems. As a result, EPA officials claim that many communities have incorporated controls, such as erosion and stormwater control measures, into local ordinances. Also, in recent years, several states, such as Maryland, have developed statewide erosion and stormwater runoff regulations.

3.3.3 Provisions Affecting Input Industries

Input industries are affected by the Clean Water Act through four sets of effluent standards: pretreatment, direct discharge, new source performance, and toxic effluent standards. Initial development of regulations for each set is aimed at "primary" industrial categories, lists which can be expanded at EPA's discretion. The Clean Water Act identifies primary industries for which these standards must be promulgated. The list includes several industries which produce materials used in constructing housing. These industries are shown in Exhibit 3-2.

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[1] Some communities require both careful stormwater management and extensive storm sewers. Clearly such a "belt and suspenders" approach will increase development costs.

Pretreatment standards apply to sources discharging effluent to POTWs which could upset the treatment process or could pass through unaltered. EPA's regulations include general prohibitions as well as categorical standards for each industry group.

Direct discharge standards apply to existing sources not discharging to a public sewer system. These standards are to be implemented in two phases. Limitations based on the estimation of Best Conventional Technology (BCT) standards are required for conventional pollutants: BOD, fecal coliform, pH, grease, oil, and suspended solids. In addition, for all dischargers of toxic nonconventional pollutants EPA has developed stricter standards requiring the Best Available Technology Economically Achievable (BAT).

New Source Performance Standards apply to new or modified sources and are based on the best available demonstrated control technology. These limits in many cases approximate the BAT effluent standards.

The Act's final set of emission limits is for toxic pollutants. Toxic standards apply to 65 classes of pollutants.

The mechanism for applying these four types of emission standards is the NPDES permit. For each effluent source the relevant emission limitations serve as a minimum standard, subject to more stringent limitations if the receiving body is designated as a high quality stream. The permit requirements for each source will thus vary, despite similarities in production processes.

Link to Housing Costs--

Point source effluent limitations affect two housing cost components: construction costs and operating costs. In both cases,

EXHIBIT 3-2

HOUSING-RELATED INDUSTRIES IDENTIFIED BY THE CLEAN WATER ACT FOR REGULATION

- Paperboard, builder's paper and board mills
- Cement manufacturing
- Electroplating
- Petroleum refining
- Iron and steel manufacturing
- Nonferrous metals manufacturing
- Steam electric powerplants
- Ferroalloy manufacturing
- Glass and asbestos manufacturing
- Timber products processing

Source: Clean Water Act, Section 306(b)(1)(A) the cost impacts result from industrial sources being required to install treatment equipment or alter operations to comply with effluent limitations. These cost impacts will be passed along in the price of construction materials in industries such as timber processing. Operating costs in the form of utility payments will be affected when the point source produces energy supplied to homes, such as oil or electricity.

Implementation Status--

EPA standards for conventional pollutants were originally promulgated as Best Practicable Technology (BPT) controls and were to be in place for affected industries by July 1, 1977. BAT controls were to be installed by July 1, 1983. Approximately 20% of the affected industries failed to meet the 1977 deadline. However, the 1977 Clean Water Act extended the 1983 deadline for achieving the BAT standard and replaced the BPT standard with guidelines reflecting BCT controls. BCT incorporates cost considerations in setting effluent limits.

The housing-related industries for which pretreatment standards have been established are presented in Exhibit 3-3. BAT standards for direct discharges of effluent are currently undergoing revision on a schedule established in the consent decree under NRDC vs. Train.[1] Pre-treatment, new source, and toxic standards have or are being developed simultaneously for the housing-related industries shown in Exhibit 3-4.

Because of the incomplete status of these regulations, the final cost impacts of the Clean Water Act on industry have not yet been determined. BPT guidelines have been in effect for several years in most industries and therefore, some costs have already made their way through to housing materials and operating costs. Despite the current uncertainty over the final regulations, NPDES permits are still being issued based on estimations of what the new

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[1] 12 ERC 1833.

EXHIBIT 3-3

HOUSING-RELATED INDUSTRIES FOR WHICH PRETREATMENT STANDARDS ARE IN FORCE
(March 1981)

- Cement Manufacturing
- Electroplating[1]
- Petroleum Refining[1]
- Iron and Steel Manufacturing[1]
- Nonferrous Metals Manufacturing[1]
- Steam Electric Power Generating
- Ferroralloy Manufacturing
- Glass Manufacturing
- Builders Paper and Roofing
- Coal Mining[1]
- Mineral Mining and Processing
- Ore Mining and Dressing[1]
- Paving and Roofing Materials
- Paint Formulating[1]
- Gum and Wood Chemicals[1]
- Asbestos Manufacturing
- Timber Products Processing

[1] These industries are also required to pretreat discharges of toxic substances (as mandated by 40 CFR 403), in addition to pretreating their normal strength effluents.

Source: EPA Pretreatment Standards, 40 CFR 403.

EXHIBIT 3-4

EFFLUENT STANDARD PROMULGATION SCHEDULE UNDER NRDC vs. TRAIN FOR HOUSING-RELATED INDUSTRIES[1]

Industry	Proposal Date	Promulgation Date
Aluminum forming	2/81	9/81
Copper forming	1/81	9/81
Electroplating and Mechanical Products	3/81	10/81
Foundries	12/80	7/81
Iron and Steel	12/80	8/81
Porcelain Enamel	1/81	8/81
Gum and Wood Chemicals (exempted under Paragraph 8 of consent decree)	**	**
Paint and Ink	9/79	4/81
Pulp and Paper	11/80	6/81
Timber	9/79	1/81
Coal Mining	12/80	6/81
Ore Mining	12/80	7/81
Petroleum Refining	9/79	5/81
Steam Electric	6/80	3/81
Electric and Electronic Components	3/81	11/81

[1] Source: NRDC v. Train, 12 ERC 1833 (March 13, 1979, as amended).

standards will contain. These permits generally do not extend beyond 1981. The next round of permitting after the new standards are issued may generate substantial changes in manufacturer's costs, and in the prices of building materials.

Citations--

Legislation--
Federal Water Pollution Control Act of 1972: PL 92-500, PL 93-243, PL 95-217.

Key Regulations--
40 CFR 122 National Pollution Discharge Elimination System
40 CRF 35 Construction Grants Program
40 CFR 125 Criteria and Standards for NPDES
40 CFR 129 Secondary Treatment Information
40 CFR 403-460 Effluent Guidelines and Standards

3.4 THE CLEAN AIR ACT

The Clean Air Act (of 1970 and as amended in 1977) directs EPA to set national primary and secondary ambient air quality standards for pollutants which affect public health and welfare. Standards have been set for seven criteria pollutants which are to be met through strategies developed in State Implementation Plans (SIPs). The plans must include emission limitations for existing stationary sources; a permit program for new stationary sources in areas violating ambient standards (non-attainment areas); and a permit program to prevent significant deterioration (PSD) of air quality in areas meeting ambient standards. The exact limitations on specific existing sources and the overall emphasis on different strategies vary among states.

In addition, the Act directs EPA to establish regulations for categories of new sources which contribute significantly to air pollution. The twenty-nine categories of New Source Performance Standards (NSPS) represent minimum national emissions limitations which may be tightened in permits issued for specific sources. In nonattainment areas the permit applicant must also ensure that air quality is improved after the source begins operations, usually by arranging a reduction in emissions from another source. In PSD areas, new sources are not permitted to increase ambient pollutant levels by more than a specified amount.

The Act also directs EPA to establish national emissions standards for hazardous air pollutants (NESHAPs) which are especially threatening to human health. Of the five substances so far identified, only asbestos has a significant direct use in housing. EPA regulations address emissions during asbestos manufacture, installation, and disposal, as well as its handling during demolition of buildings.

Complementing the above provisions on stationary sources, Title II of the Act instructs EPA to develop emission standards for mobile sources which include trucks and heavy duty construction vehicles. EPA regulations are to stipulate reporting and recall procedures for manufacturers, as well as emission standards for their vehicles and engines.

Link to Housing Costs

The Clean Air Act affects housing costs primarily through its regulation of stationary air pollution sources, the manufacturing processes for materials which are used in housing construction. The NSPS, NESHAPs, and existing source standards, as applied through source permits, affect industrial production costs by forcing changes in emission control technology, operating procedures, and fuel use. These costs affect housing by altering the price of materials delivered to the construction site. Mobile source standards will primarily affect construction costs via the purchase price of heavy duty construction equipment. For some categories, (for example electrical generating stations) the effects of source limits and permit processes on utility costs will be felt directly through home operating costs.

The asbestos regulations principally affect construction and site clearance costs through regulation of installation of new asbestos, and control over demolition of old asbestos-containing structures.

Finally, the potential exists for SIPs to address control of major land developments both as stationary sources and as indirect sources. Land use regulations or incentive programs could be designed to encourage high density development or to discourage population growth in specific areas. Such strategies could affect land costs by affecting land supply, construction costs by discouraging free-standing houses, or public facilities costs by creating more compact service areas. In addition, strategies such as regulating emissions from home furnaces, water heaters and fireplaces could change home operating costs through fuel payments or pollution control equipment costs.

Implementation Status

Many of the provisions of the Clean Air Act have been in effect for a number of years. Except for lead, ambient standards for all the criteria pollutants were promulgated in 1971. The 1977 Clean Air Act Amendments, however, required EPA to review the standards for ozone, particulates, SO_2, NO_2, and CO by the end of 1980. EPA relaxed the ozone standard in 1979, but has not yet issued final findings on the remaining pollutants. The 1977 Amendments to the Act also relaxed the deadlines for meeting the primary standards to 1987 for ozone and carbon monoxide, and to 1982 for particulates, sulfur dioxide, and nitrogen dioxide.

NSPS regulations have currently been issued for 29 source categories. The categories and the promulgation dates of the standards are presented in Exhibit 3-5.

Emissions standards for gasoline-fueled heavy duty vehicles were first promulgated for the 1970 model year for hydrocarbons and CO. Optional standards were developed for 1979-19823 vehicles and are to be followed by stricter hydrocarbon, CO and NO_x standards applicable to 1984 model vehicles. Heavy duty diesel standards were first applied in 1970 for smoke and in 1974 for CO, NO_x, and hydrocarbons. These standards were tightened for 1979 vehicles and are expected to become more stringent in 1984. NESHAPs standards for asbestos were promulgated in 1973.

EXHIBIT 3-5

NSPS CATEGORIES RELEVANT TO HOUSING COSTS

Industrial Category	Promulgation Date
Fossil Fuel Fired Generators (post 1971)	1971
Electric Utility Steam Generating Units (post 1978)	1979
Incinerators	1971
Portland Cement Plants	1971
Asphalt Concrete Plants	1974
Petroleum Refineries	1974
Storage Vessels for Petroleum Liquids	1974
Iron and Steel Plants	1974
Sewage Treatment Plants	1974
Primary Copper Smelters	1976
Primary Aluminum Reduction Plants	1974
Coal Preparation Plants	1974
Ferroalloy Production Facilities	1974
Steel Plants: Electric Arc Furnaces	1975
Kraft Pulp Mills	1976
Stationary Gas Turbines	1979
Glass Manufacturing	1980
Relevant Projected NSPS Categories	
Industrial Surface Coating: Large Appliances	1981
Industrial Boilers	1981
Asphalt Roofing Manufacture	1981

The SIPs, originally approved in the mid-1970s, are currently undergoing extensive revisions to meet the 1977 Amendment's provisions for PSD and nonattainment areas. As of October 1980, 40 of the 50 states required to submit nonattainment area plans have prepared complete plans. Final action had been taken on 18 of these plans (of which one was disapproved).

Despite the uncertainty over the ambient standards and the SIPs, permitting has not yet been seriously disrupted. Most states have received conditional approvals of at least parts of their plans and have been able to estimate workable permit requirements for the interim. For some of the states which have yet to submit SIPs, sanctions imposed by EPA may prevent the issuing of permits for industrial construction or expansion.

Citations

Legislation--
Clean Air Act of 1970: PL 91-604 as amended by
Clean Air Act of 1977: PL 92-157, PL 93-15, PL 93-319, PL 95-95

Key Regulations--
40 CFR 50 National Primary and Secondary Ambient Air Quality Standards
40 CFR 51 Preparation of Implementation Plans
40 CFR 60 Standards of Performance for New Stationary Sources
40 CFR 61 National Emission Standards for Hazardous Air Pollutants
40 CFR 85-86 Control of Air Pollution from New Motor Vehicle Engines

3.5 NOISE CONTROL ACT OF 1972; QUIET COMMUNITIES ACT OF 1978

The Noise Control Act of 1972 directs EPA to identify noise sources which affect public health and to establish regulations for products identified as major noise sources. EPA is authorized to set noise emission standards for new equipment in four categories: construction equipment; transportation equipment; motors and engines; and electrical or electronic equipment. Current regulations include testing and recordkeeping procedures for manufacturers as well as emission standards for new equipment.

The Quiet Communities Act of 1978 authorizes EPA to establish a program of research, demonstrations, grants and technical assistance to aid states and communities in developing noise abatement programs.

Link to Housing Costs

The emissions limitations and manufacturer requirements of the Noise Control Act affect housing costs through changes in the purchase price of new construction-related equipment. Construction costs will be affected by regulation of land clearing, demolition, or construction equipment. Home operating costs may also possibly be affected through taxes or special fees as a result of cost changes incurred by manufacturers of regulated equipment such as garbage trucks.

EPA programs developed under the Quiet Communities Act affect housing costs by accelerating the development of local or state noise control capabilities. Local programs can confine housing construction to daylight hours, or require noise-reducing features in design review or building codes.

Implementation Status

Noise emission standards for new portable air compressors and for medium and heavy trucks became effective in January 1978, with stricter truck standards being considered for 1985 (standards for garbage trucks became effective in October 1980). These three types of equipment are the only categories for which cost impacts could yet exist.

Standards for crawler tractors and wheel loaders used in site preparation have been proposed but are not expected to become effective before 1984. Pavement breakers and rock drills have been identified as major noise sources but no standards have yet been proposed. Regulation of this equipment is unlikely prior to the mid-1980s.

As of 1977, 1,067 municipalities in the U.S. enforced some type of noise control.[1] About 600 localities regulate noise levels by specifying emission limits based on zoning district or land use type. Approximately 130 cities restrict noise at construction sites through absolute decible limits or restrictions of construction to daylight hours. In 52 municipalities, noise reduction standards or materials have been specified in building codes. These local noise ordinances can exert dramatic impacts on construction practices, but vary so widely among communities as to make generalizations of impacts very difficult.

Citations

Legislation--
Noise Control Act of 1972: PL 92-574 as amended by PL 94-301
Quiet Communities Act of 1978: PL 95-609

Key Regulations--
40 CFR 204 Noise Emission Standards for Construction Equipment
40 CFR 205 Transportation Equipment Noise Emission Controls

3.6 NATIONAL FLOOD INSURANCE ACT OF 1968: PL 90-448; FLOOD DISASTER PROTECTION ACT OF 1973: PL 93-234

The Flood Insurance Act establishes a program for providing flood insurance to property owners in identified flood hazard zones. The Act prohibits federal agencies from providing financial assistance, such as mortgages from FDIC insured banks, for purchase or construction of structures within identified flood hazard zones if the communityis not a participant in the flood insurance program and the owner does not have flood insurance. The community and individual participation requirements were introduced in the 1973 Act, effectively transforming the program from a voluntary to a mandatory one.

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[1] U.S. Environmental Protection Agency. The Status of Noise Control in the United States: State and Local Government. Washington, D.C.: Office of Noise Abatement Control, April 1978.

The flood insurance program has both emergency and regular phases. In the emergency phase, home owners in the flood plain pay uniform federally-subsidized rates for insurance provided by private firms. In the regular phase, insurance rates are based on actuarial estimates of risk as determined from a detailed map of the hazard zone.

To qualify for the regular phase, the community must establish certain controls in the flood plain, including: a permit process for new development; required elevation of new residential structures above base flood level; required elevation above or waterproofing below the base flood level for new non-residential structures; required waterproofing of new utilities; and prohibition of any development in the floodway which would raise the level of the base flood by more than one foot. The community has the option of implementing these requirements through its zoning ordinance, subdivision regulations, or building or health codes.

The Act also requires state facilities to comply with local flood plain regulations or with the federal program requirements. Executive Order 11988 makes minimization of flood damage risk an objective of each federal agency and directs the federal agencies to be consistent with the program.

Link to Housing Costs

The Flood Insurance Act affects three types of housing costs in flood hazard areas: land costs, expenses for constructing compliance measures, and operating costs. Operating costs are affected most directly via the payments homeowners make for insurance coverage. During the emergency phase the rates for residences are set at 25¢ per $100 of coverage, but for the regular phase are bsed on an actuarial assessment of risk. These rates are also subsidized, but are higher than the emergency rate. Operating costs are also affected where local regulations require floodproofing of new utilities and where federal policy dictates floodproofing of public projects such as sewage treatment plants. These cost impacts will appear in taxes and utility fees.

Compliance costs are affected directly through local regulations on land prices. Potential mechanisms include: prohibitions or restrictions on uses, special construction or design requirements, and the costs of flood insurance, all of which affect preferences for land and its supply, and therefore land costs.

Implementation Status

As of March 1980, 16,816 communities were participating in the National Flood Insurance Program, 4,700 in the regular phase and 12,116 in the emergency phase. A total of 1.56 million residential policies are currently in effect, amounting to more than $61 billion in coverage.

Citations

Legislation--
National Flood Insurance Act of 1968: PL 90-448
Flood Disaster Protection Act of 1973: PL 93-234

Key Regulations--
24 CFR 1910 Criteria for Land Management and Use
24 CRF 1911 Insurance Coverage and Rates

3.7 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

NEPA directs all federal agencies to assess the impacts of their major actions upon the quality of the environment. For some actions, the preparation of a relatively brief Environmental Impact Assessment (EIA) is sufficient to show that the action will have little or no environmental impact. In other cases, preparation of an extensive Environmental Impact Statement (EIS) is necessary. Council on Environmental Quality guidelines outline proper EIS content and procedure, and each agency has regulations defining which of its actions are subject to the EIS requirement.

Although all agencies are required to file EIA/EISs for all major actions, relatively few of these actions affect housing cost components. The whole class of generic EISs prepared for major new agency programs, for example, have little effect on housing development. Many environmental programs with connections to housing costs are implemented by state or local governments, so that federal action is rarely involved at the project level. Most EIS-triggering actions directly related to housing costs can be traced to a few federal actors: HUD, EPA, FmHA, Veterans Administration (VA), the energy agencies, and the Army Corps of Engineers.

HUD regulations specify two stages of environmental assessment: normal and special environmental clearances. Both clearances are accomplished by completing short standard forms; this generally involves a maximum of 2 to 3 days of staff preparation. The HUD program of greatest impact for new housing costs is the FHA mortgage insurance program for new construction. In the fall of 1979, HUD issued regulations which established a range of project size thresholds which routinely require preparation of a full EIS. The threshold is based upon the characteristics of the projects' surroundings, and range from project sizes of 500 dwelling units in rural areas to 2500 units in rapidly growing areas in urban countries.

In the last two years, HUD has initiated three review procedures which have focused reviews on specific areas of concern to the federal agency, and in otherwise reducing the burden of these reviews on developers. The first initiative is the Local Area Certification Process. This is being used in areas which are undergoing large volumes of subdivision activity, and in which local development review processes have been implemented. In these areas, HUD certifies the local government to deal with environmental issues. The agency will only conduct reviews of specific potential environmental problems which are not covered directly by a local ordinance or requirement. For example, many communities do not have noise ordinances, so HUD's environmental review of a subdivision proposed for a site judged to be sensitive to this type of impact may be limited to this one issue in a community which is otherwise locally certified. Second, HUD has recently started a program of areawide environmental reviews, which examine cumulative environmental impacts that could potentially be created by the implementation of all of the agency's housing programs operating in a given area. In these localities, full EISs are not required for individual developments, although the local HUD office must ensure that there are no additional impacts that could result from a site-specific proposal. Finally, HUD has initiated an "Early Start" program, in which construction of up to 200 units of a large project may begin during EIS review provided that several criteria are met:

- o HUD's ECO 2/3 application is implemented;
- o the initial project increment is self-sufficient in the event that the remainder of the project is turned down; and
- o plans for EIS completion have been established.

Two of EPA's programs with major impacts on housing costs require environmental reviews: construction grants for municipal wastewater treatment plants and issuance of new source NPDES permits. For construction grants, EPA regulations require an environmental review to be integrated into the facilities planning process, to be followed, if necessary, by a full EIS. For NPDES permits, EISs are prepared for new source permits issued directly by EPA in states within primacy under the Clean Water Act. EPA regulations require an environmental assessment with a written record, and an EIS if necessary.

The Farmers Home Administration manages assistance programs for housing and public facilities in rural areas. FmHA regulations require EIA preparation for loans for projects larger than 50 multifamily or 25 single family units or for loans for water, sewage, solid waste, or stormwater projects.

In the area of electricity generation, a number of agencies can be involved in EIS preparation. The principal actors are listed in Exhibit 3-6. The plethora of state and federal authorities involved

EXHIBIT 3-6

PRINCIPAL AGENCIES INVOLVED IN EIS PREPARATION FOR ENERGY FACILITIES

Agency	Area of Responsibility
Nuclear Regulatory Commission	Nuclear generating plants
Federal Energy Regulatory Commission	Hydroelectric and natural gas facilities
Rural Electrification Administration	Generating and transmission facilities
Tennessee Valley Authority	Generating and transmission facilities
Bonneville Power Administration	Generating and transmission facilities
Bureau of Land Management	Generating and transmission facilities on Federal lands
Army Corps of Engineers	Cooling water structures in navigable waters

Source: Environmental Protection Agency, Printout of EISs prepared in 1979.

in construction and operation of electric power systems ensures that every major generating or transmission facility will go through an EIS process at some point in its conception or construction.

The U.S. Army Corps of Engineers, in addition to its permitting role for cooling water intakes, also issues dredge and fill permits under Section 404 of the Clean Water Act. Under Corps regulations, issuance of a permit triggers an environmental assessment.

NEPA has inspired many states to adopt "little NEPAs"--environmental impact assessment processes for major proposals from private developers, direct state action, or federal actions.

Link to Housing Costs

The state and federal EIA/EIS processes affect housing cost components in three ways: administrative costs of preparation of the documents; carrying costs incurred during the study and review periods; and compliance costs for mitigating impacts identified during the process. For EPA construction grant projects, energy licensing and permitting procedures, and FmHA public facilities loans, EIS costs are passed on through home operating costs in the form of taxes, sewer fees, or utility bills. For industrial NPDES permits, EIS costs will be transmitted through the costs of construction materials. For FHA mortgage projects or private housing developments triggering a state process, EIS costs will affect the developer's construction and carrying costs.

Implementation Status

CEQ's original guidelines on EIS/EIA preparation were revised in July 1979. The new guidelines are intended to streamline EIS preparation and reduce document size by encouraging a more focused assessment of the principal issues. Since few if any projects reviewed under the new guidelines have begun construction yet, any costs resulting from EIS preparation in completed projects must be ascribed to the earlier process.

HUD's environmental review procedures were revised in November, 1979. Normal or special clearances are completed for all HUD projects, normally involving less than a week of staff preparation time. HUD prepared 130 EISs and supplements in 1979; 88 of these pertained to the provision of mortgage insurance for new housing developments. While no central records are kept showing the number of communities certified for the Local Area Certification Program, it is estimated that approximately 100 communities across the country have been certified as to the adequacy of their reviews in meeting HUD's environmental concerns. Two Areawide EISs have been prepared to date. The workings of the Early Start program are described in Chapter 5 below, in the context of two case studies in the Dallas metropolitan area.

VA initially published EIS procedures in August 1979; these were revised in September 1980. The procedures are compatible with those of FmHA and FHA. In 1979, VA did not prepare any EISs on housing developments with loan guarantees.

EPA's EIS regulations were promulgated in 1975 and have been amended five times through November 1979. In 1979 EPA filed 41 statements or supplements concerning municipal construction grants and nine for new source NPDES permits.

The Farmers Home Administration prepared no EISs on housing projects in 1979. As with HUD, field or state level staff determine on the basis of initial assessment whether an EIS is necessary. As a result, EISs are rather rare. FmHA is currently preparing to propose a new rule which would standardize the decision process and make EIS preparation mandatory in more instances.

The federal agencies involved in licensing and permitting of electricity generating stations produced about 50 EISs in 1979 for various generating and transmission facilities. The Corps of Engineers produced four EISs on major dredge and fill projects involving new housing development.

The state environmental impact processes are often directed more toward housing projects than the federal process, as state assessments are generally triggered by developments with no federal or state action required. Exhibit 3-7 lists the "little NEPAs" in effect as of June 1979.

Citations

Legislation--
National Environmental Policy Act of 1969: PL 91-190

Key Regulations--
7 CFR 1901 Program-Related Instructions (FmHA)
10 CFR 51 Licensing and Regulatory Policy and Procedures for Environmental Protection (NRC)
10 CFR 208 Compliance with the National Environmental Policy Act (DOE)
40 CFR Preparation of EISs (EPA)
40 CFR 1500-1508 National Environmental Policy Act - Regulations (CEQ)

3.8 COASTAL ZONE MANAGEMENT ACT

The Coastal Zone Management Act of 1972 established a grant program for states to develop and admnister management programs for lands along their coastlines. To be eligible for funds, a state program must include provisions specifying the land or water uses and the geographic areas that are subject to management under the program.

Within the federal regulations, the states have great latitude in setting up their programs. Typical program components are designation of areas of environmental concern, special permits for particular uses or in certain areas, and special construction or mitigation requirements. State programs can be administered by a specially-created agency or commission, or can consist entirely of a coordination and review process for existing state and local regulatory programs.

EXHIBIT 3-7

STATES WITH ENVIRONMENTAL IMPACT REVIEW PROCESSES

States with Comprehensive Statutory Requirements

- California
- Connecticut
- Hawaii
- Indiana
- Maryland
- Massachusetts
- Minnesota
- Montana
- New York
- North Carolina
- South Dakota
- Virginia
- Washington
- Wisconsin
- Puerto Rico

States with Comprehensive Executive or Administrative Orders

- Michigan
- New Jersey
- Texas
- Utah

States with Special or Limited EIS Requirements

- Arizona
- Delaware
- Georgia
- Kentucky
- Mississippi
- Nebraska
- Nevada
- New Jersey
- Rhode Island

Source: Council on Environmental Quality.

Link to Housing Costs

State CZM programs affect several components of housing costs. Designation of special areas and use restrictions limit the supply of developable land and may affect land costs. Construction restrictions and mitigation requirements affect costs of land development and construction. Permit procedures introduce delay into the development process and affect carrying costs.

Implementation Status

Twenty-five states and territories are expected to have EPA-approved CZM programs by the end of 1980. The status of these state programs is summarized in Exhibit 3-8.

Citations

Legislation--
Coastal Zone Management Act of 1972: PL 92-583 as amended by
PL 93-612, PL 94-370

Key Regulations--
15 CFR 923 CZM Program Development Grants
15 CFR 926 CZM Program Approval Regulations

3.9 SUMMARY

The potential impacts of federal environmental legislation on housing costs are summarized in Exhibit 3-9. This exhibit presents potential impacts in terms of costs which are directly borne by the developer, and costs which are ultimately paid the property owner. This exhibit shows that federal environmental laws and their implementing regulations can potentially affect every category of cost.

Administrative costs are affected by requirements for special studies or for specialized design and engineering work. The laws with the highest potential for major impacts in this category are the Clean Water Act, NEPA, and the noise and flood protection laws. Carrying costs are obviously most affected by laws which require additional reviews by federal, state, or local governments. These

EXHIBIT 3-8

STATUS OF STATE COASTAL ZONE MANAGEMENT PROGRAMS

State	Actual or Estimated Federal Approval Date for CZM Plans (Fiscal Year)
Washington	1976
Oregon	1977
California	1978
Massachusetts	1978
Wisconsin	1978
Rhode Island	1978
Michigan	1978
North Carolina	1978
Puerto Rico	1978
Hawaii	1978
Maine	1978
Maryland	1978
New Jersey (Bay and ocean shores)	1978
Virgin Islands	1979
Alaska	1979
Guam	1979
Delaware	1979
Alabama	1979
South Carolina	1979
Louisiana	1980
Mississippi	1980
Connecticut	1980
Pennsylvania	1980
New Jersey	1980
New Hampshire	1982
Texas	1982
North Marianas	1980
American Samoa	1980
Indiana	No Estimate
Ohio	No Estimate
New York	1982
Florida	1981
Georgia	Approval Unlikely
Virginia	Approval Unlikely
Minnesota	Approval Unlikely
Illinois	Approval Unlikely

Source: Council on Environmental Quality, op.cit., p.501, updated by Coastal Zone Management Agency, April 1981.

EXHIBIT 3-9

SUMMARY OF POTENTIAL COST IMPACTS OF FEDERAL ENVIRONMENTAL LEGISLATION

Legislation	Direct Developer Costs				Other Costs	
	Administrative	Carrying	Compliance	Impact	Land Prices	Operating
Safe Drinking Water Act		-delays from EPA reviews of projects affecting sole source aquifer areas	-mitigating impacts in sole source aquifer recharge areas			-user charges for upgrading supplies to meet MCLs, mitigating impacts in sole source aquifer recharge areas
Resource Conservation and Recovery Act				-materials costs reflect hazardous waste management requirements		-charges and/or increases in property taxes for upgrading disposal facilities
Clean Water Act	-special studies of wastewater management issues may be needed for point & nonpoint sources	-limits on sewerage capacity may delay project approvals -delays can result from reviews of management strategies for point & nonpoint sources	-special sanitary or nonpoint wastewater management measures	-pretreatment, direct discharge, new source performance & toxic effluent standards affect materials costs	-limits on sewerage capacity may limit supply of land available for development	-user charges for wastewater management controls, increases in property taxes for capital expenditures
Clean Air Act			-asbestos regulations will affect construction practices	-stationary source controls required by NSPS, NESHAPS, & existing source controls -mobile source controls of heavy construction equipment	-control strategies could affect land development patterns	-emission limits reflected in higher utility bills -emission controls on home furnaces, etc. may lead to higher fuel and/or equipment costs
Noise Legislation	-design requirements for noise reduction		-regulation of construction activities	-increased costs for construction equipment		-increased costs of operating municipal equipment
Flood Disaster Protection and Insurance Acts	-flood hazard studies, mitigation design		-costs of elevating structures & roads -opportunity costs of land prohibited from development		-control measures which restrict the supply of land for building	-insurance payments -costs of floodproofing services
National Environmental Protection Act	-preparation of EIAs, EISs	-carrying costs during EIS review -increased financing costs for subsidy programs	-construction of mitigation measures	-EIS preparation costs for industrial facilities		-EIS preparation costs for public facilities
Coastal Zone Management Act		-assessments, permit procedures may affect review time	-construction of mitigation for sensitive areas		-strategies may affect the supply of land	

reviews can lengthen a project's planning period, thus increasing property taxes, insurance and land financing payments, as well as making the project more vulnerable to inflation. The federal environmental laws with the highest potential for affecting carrying costs are the Safe Drinking Water Act, the Clean Water Act, NEPA, and the Coastal Zone Management Act.

Compliance costs can be affected by all but one of these laws. Only the Resource Conservation and Recovery Act does not require mitigation of problems by indivivdual developers. All of the other laws have the potential to require the developer to mitigate environmental problems--either through changes or additions to the project design, or through reductions in the project's scope. This cost category includes expenses for building materials, equipment and labor necessary to construct mitigation measures. It also includes costs which may be incurred through requirements affecting construction practices. These could include soil erosion control measures required under the Clean Water Act, asbestos management strategies required under the Clean Air Act, or measures which confine construction to daylight hours to minimize noise impacts.

Several federal environmental laws have the potential to affect a housing project's indirect costs through pollution control requirements for producers of building materials. The three laws with the potential for the highest costs in this category are those that directly regulate emissions: the Clean Water Act, the Clean Air Act, and RCRA's hazardous waste management requirements. In addition, NEPA can potentially increase the costs of input materials as EISs are required for new industrial facilities, and noise legislation can increase the cost of construction equipment as machines become specially fitted to reduce noise levels.

These laws also affect other costs in several ways. Land prices are affected as these requirements are implemented in such a way as to decrease the supply of land available for housing development in a community. The costs of operating and maintaining a housing unit are also affected by most of these laws, which have the potential to require user charges or increases in property taxes to pay for the development and implementation of mitigation measures. Several laws can potentially affect energy requirements, and thus a housing unit's operating costs.

It should be noted that the law with the highest potential for affecting housing costs is the Clean Water Act, the only law of the eight examined which affects each type of cost. Its requirements for management of both point and nonpoint sources of water pollution, as well as the effluent limits placed on manufacturers of building materials have resulted in costs which were previously born externally (e.g., by downstream water users) if at all.

This section has attempted to provide a framework within which an analysis of the impacts of these laws and regulations on housing costs may be performed. These chapters have outlined impact chains in a theoretical context, and have presented findings of relevant literature. However, it is also necessary to understand the ways in which these laws and regulations are implemented, in order to evaluate these potential impacts--to understand both their real incidence and magnitudes. Therefore, the following section of this report examines nine case studies of individual housing developments which encountered a variety of environmental requirements, and documents the actual cost impacts of these laws.

SECTION TWO

CASE STUDIES

CHAPTER 4

CASE STUDIES: THE BOSTON METROPOLITAN AREA

4.0 BACKGROUND

> "Boston, which now appears to the casual visitor to be built upon a solid segment of the Massachusetts coast, was in the early seventeenth century a hilly peninsula, almost completely surrounded by water...In (the ensuing) centuries the hills of the Boston peninsula have all but vanished, and so has much of the water. Long before the invention of bulldozers and stream shovels, Bostonians had begun to modify their landscape in the attempt to accommodate an expanding population on the limited site that had been chosen for a wilderness village. Here the tops of the hills have literally been taken off to fill the valleys and coves."[1]

Land development in the Boston metropolitan area has always been inexorably tied to radical alterations of the environment. The city itself is now built mostly on fill, in the place of tidal streams and inlets; the tops of the three hills that attracted the original English settlers long ago provided the necessary soil. Early developers did not consider themselves to be limited by the lack of suitable land for building--they created what was needed by the expanding population of a mercantile city.

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[1] Walter Muir Whitehill, Boston: A Topographical History Cambridge, MA: Belknap Press of the Harvard University Press, 1975. pp 1-2.

As the growth in population has slowed in recent years, this tradition of active development has turned around; the development process is now directed at protecting what remains of the area's natural environment. From the establishment of town Conservation Commissions to the passage of landmark state environmental legislation, Massachusetts has become known for itsprotectionist stance toward land development. This chapter describes the development process in Massachusetts and its impacts on the cost of housing. Section 4.1 shows how the demand for housing has slowed in recent years, with a decline in the rate of population growth. Section 4.2 describes the institutions that are involved in reviewing and approving housing developments. Case studies of four residential projects are outlined in Section 4.3, in which the impact of environmental regulations on each project is discussed.

4.1 PATTERNS OF GROWTH IN THE BOSTON METROPOLITAN AREA

The communities which surround Massachusetts Bay are a highly diverse lot, ranging from intensely urbanized older cities to rural and rapidly suburbaning towns. The Standard Metropolitan Statistical Area (SMSA), as defined for the 1970 Census, includes 75 cities and towns. As shown in Exhibit 4-1, the SMSA is bounded on the North Shore by Manchester (and excludes the Cape Ann communities of Gloucester and Rockport), by Framingham to the west, and by Duxbury on the South Shore. Exhibit 4-1 also describes Boston's urbanized area as defined for the 1970 census. For the purposes of selecting case studies for this research effort, the 92 communities which participated in the Areawide Water Quality Management Project[1] were used, since this study provided a comprehensive data base concerning growth and land use. From this data base, candidate communities for case studies were selected.

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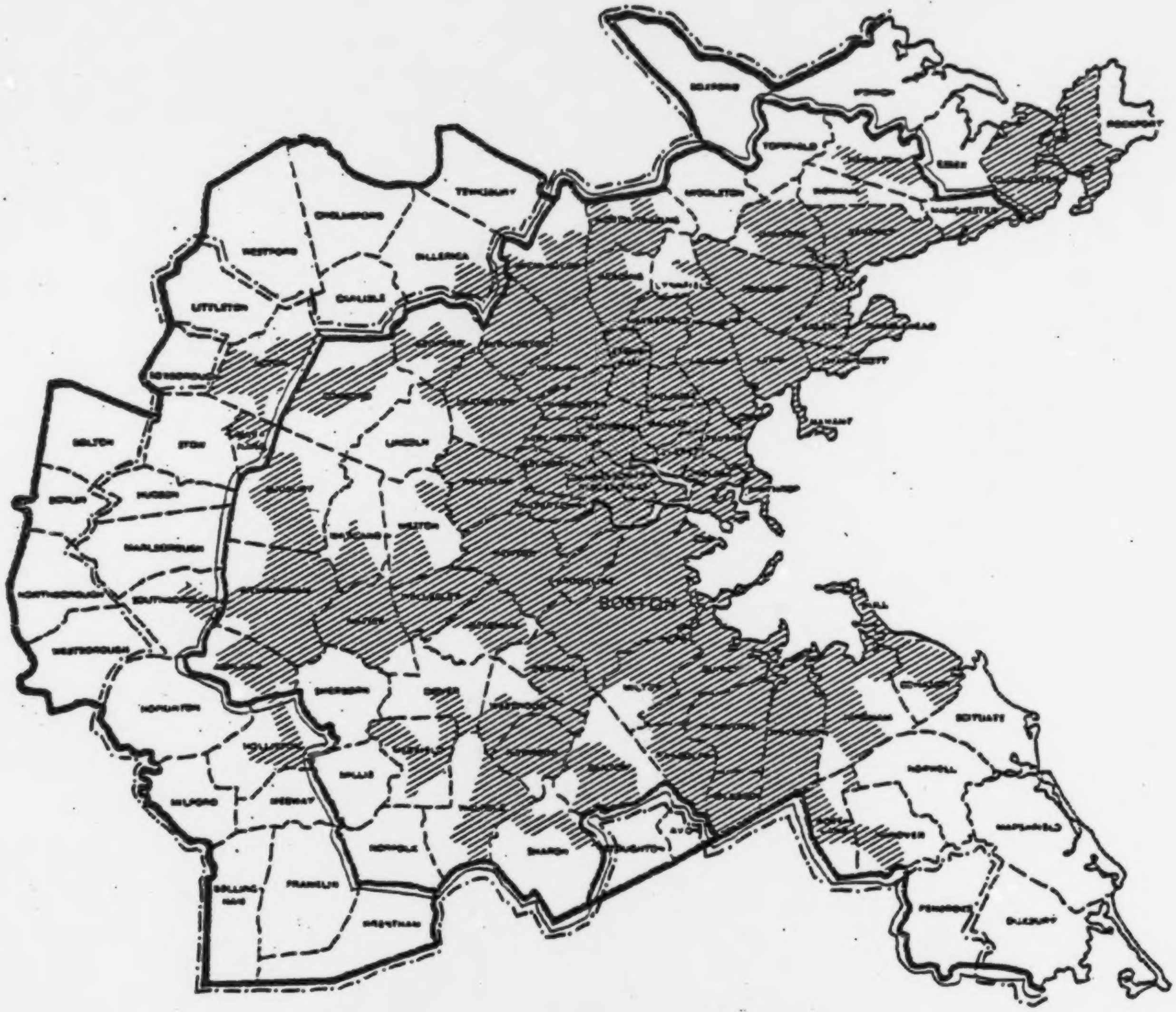
[1] This 208 study was conducted by the regional planning council for the Boston area.

EXHIBIT 4-1

Census Area Definitions

Reproduced from best available copy.


BOXFORD
IPSWICH
ROCKPORT
TOPSFIELD
ESSEX
TEWKSBURY
MIDDLETON
MANCHESTER
CHELMSFORD
WESTFORD
BILLERICA
LITTLETON
CARLISLE
BOXBOROUGH
CONCORD
BOLTON
STOW
LINCOLN
NAHANT
HUDSON
MARLBOROUGH
SUDBURY
WAYLAND
WESTON
NORTHBOROUGH
SOUTHBOROUGH
NATICK
BOSTON
WESTBOROUGH
HOPKINTON
SHERBORN
DOVER
WESTWOOD
COHASSET
SCITUATE
HOLLISTON
MEDFIELD
MILLIS
NORWELL
MILFORD
MEDWAY
MARSHFIELD
AVON
HANOVER
NORFOLK
SHARON
STOUGHTON
BELLINGHAM
FRANKLIN
WRENTHAM
PEMBROKE
DUXBURY

—·—·—	Areawide Water Quality Management Study Boundary
═══	**Outer Boundary of Boston SMSA, 1970**
▨	**Urbanized Area, 1970**

This section describes trends in the Boston area's population and economic growth. Section 4.1.1 describes recent past population trends, and Section 4.1.2 shows trends in the area's employment. The impacts of these trends on land use are described in Section 4.1.3.

4.1.1 Demographic Trends

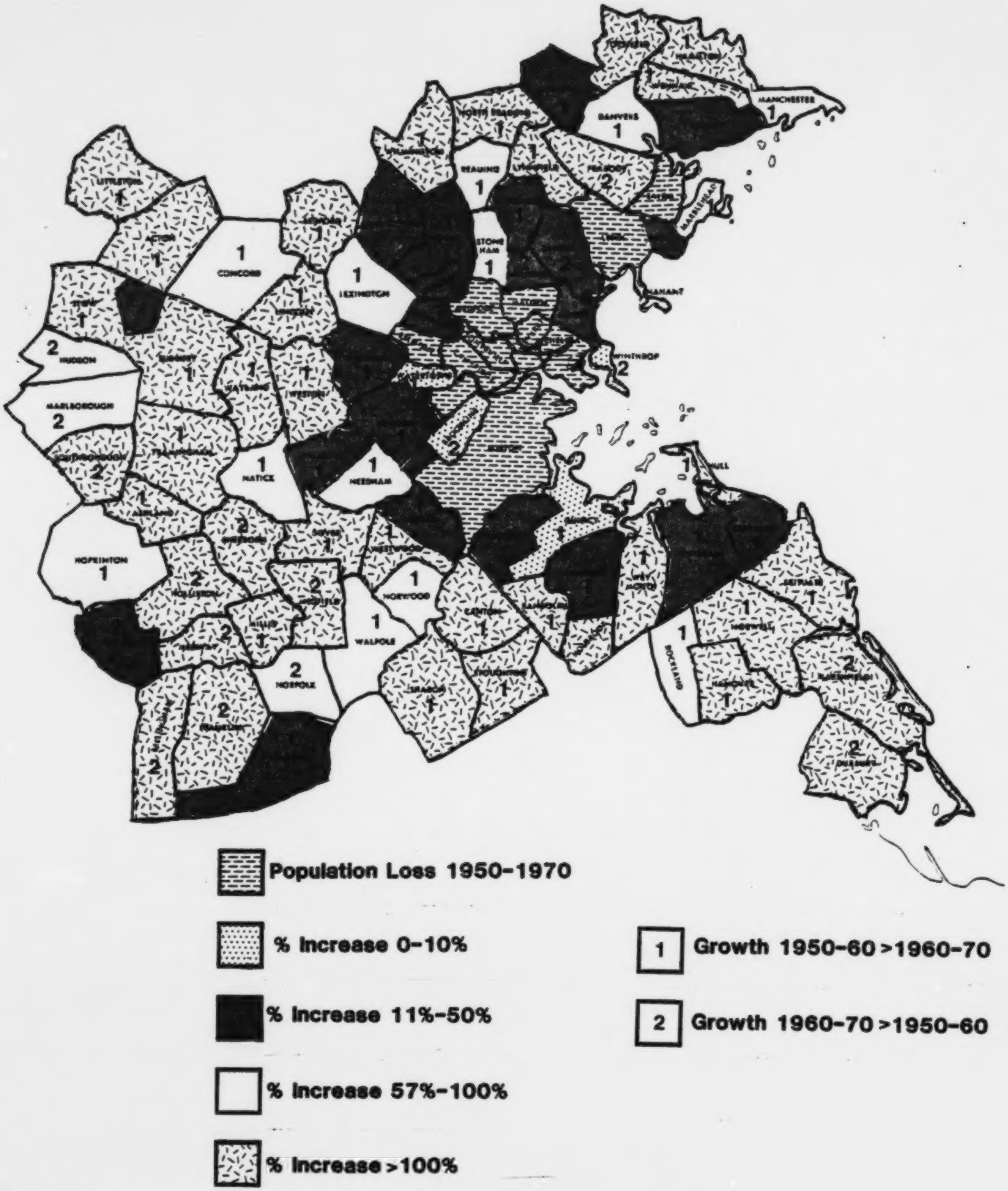
Many of the communities that are close to the original settlements around Massachusetts Bay have been centers of residential and economic activity since the Industrial Revolution--most since colonial times. Some of these communities are among the earlier suburbs which were developed prior to World War II. These are the towns which are within easy commuting distance to the employment, shopping and cultural opportunities found in Boston. Exhibit 4-2 shows that over the period from 1950 to 1970, the older urban centers (including Boston, Cambridge and Revere) generally experienced relatively large losses of population, while the inner suburban communities tended to remain stable over this period.

Other communities can be classified as newer, post World War II suburbs, growing rapidly in the wake of the construction of Route 128 (the circumferential highway built in the early 1950's). This trend is in keeping with the national movement of population outward from older urban areas. In general, older, suburban communities tended to experience rapid growth over the entire 1950-1970 period, although the rate of growth experienced over the 1950-1960 decade was considerably greater than the rate of growth during the latter decade.

Outlying communities tend to be less urbanized,and can be categorized as suburban or semi-rural in character. These communities were small, and so a relatively small numerical increase in population appears as a large percentage increase. Due to their large supplies of comparatively lower-cost land available for development

EXHIBIT 4-2

POPULATION CHANGES IN THE BOSTON AREA


MANCHESTER
DANVERS
READING
STONE HAM
LEXINGTON
CONCORD
ACTON
LITTLETON
HUDSON
MARLBOROUGH
NATICK
NEEDHAM
HOPKINTON
NORWOOD
WALPOLE
NORFOLK
NAHANT
WINTHROP
BOSTON
HULL
ROCKLAND
Population Loss 1950-1970
% Increase 0-10%
% Increase 11%-50%
% Increase 57%-100%
% Increase >100%
1 Growth 1950-60 >1960-70
2 Growth 1960-70 >1950-60

(compared to the older suburbs and cities), these less-urbanized towns are now experiencing most of the population increases. Some of these communities are relying on strict land use and environmental controls to retain their perceived rural character; others are more open to development.

As shown in Exhibit 4-3, population within this study area increased by 17% between 1950 and 1970--from roughly 2.5 million people in 1950 to approximately 2.9 million people in 1970. The majority of this population increase occurred between 1950 and 1960. The next decade was one of stabilization for the area as a whole. Population data showing trends in individual communities have not yet been published from the 1980 census. However, preliminary estimates indicate that the trend toward stabilization continued between 1970 and 1980 with only the more rural communities showing signs of significant growth in population.

4.1.2 Trends in Economic Activities

The earliest economic activities in the region started along the edge of Boston Harbor, supporting the shipping industry that provided access from New England to the rest of the world. The region's rivers were also important factors in the areas' development, since they provided power for early mills and access to New England's interior. In the 19th century, Boston, which has been the largest city in New England since colonial times, became the financial center of the region.

Economic activities have developed in several centers in the region's urbanized core. The bulk of the area's employment is still concentrated in these centers. The City of Boston alone accounted for more than 35% of the area's jobs in 1975. Other major employment centers include Cambridge, Waltham, Lynn, Newton, Quincy, Framingham, and Somerville. In many communities, economic activities provided the nucleus of a town center or a village--a development pattern which continues even when the original mill or industry has departed.

EXHIBIT 4-3

AREAWIDE POPULATION GROWTH
1950 - 1970

	Areawide Total
Population in 1950	2,507,268
Population in 1960	2,718,759
% change 1950-1960	8.4%
Population in 1970	2,933,091
% change 1960-1970	7.9%
% change 1950-1970	17.0%

Some of the area's older cities, while located some distance from Boston, have attracted a significant amount of manufacturing. These include the communities of Peabody, Lynn, Salem and Malden on the North Shore, Watertown to the west, and Quincy on the South Shore. In communities where economic development was facilitated by the construction of Route 128 in the early 1950's, growth of the manufacturing sector has frequently been matched by the development of the trade sector serving the substantial new residential development in these communities. Eleven of these communities have provided sites for large-scale regional shopping centers,and have been the site of intensive development of strip commercial areas along major highways.

In the region as a whole, Exhibit 4-4 shows that the manufacturing and services sectors account for the most jobs, representing 21 and 23% of the area's total employment respectively. Boston and the core cities remain the location of much of the region's service-oriented activities, including finance, insurance, real estate, and government, as well as the usual personal and business services. Overall, these activities accounted for approximately 27% of the area's total employment in 1975. This is partly due to Boston's position as the financial center of New England as well as the capital of Massachusetts. This situation can also be attributed to the overwhelming influence of the area's colleges and universities which are mostly located within these core communities. It should also be noted that, while many of these institutions are located in the area's central cities, many of their "spin-off" research and development firms have moved to the areas around Route 128 from the core.

As could be expected in an urbanized region, agriculture and mining do not play important roles in the region's economy, although these activities are playing a small role in the economic base of many of the suburban and rural communities. Agricultural activities (including fishing as well as farming) are primarily found in the

EXHIBIT 4-4

AREAWIDE EMPLOYMENT BY SECTOR 1975

SECTOR	1975 Employment	1975 % Total Employment
Agriculture, Forestry, Fishing	9,755	0.7
Construction	42,231	3.2
Transportation, Communications, Utilities	65,122	4.9
Wholesale and Retail Trade	271,731	20.6
Finance, Insurance, Real Estate	86,060	6.5
Services, Mining	293,868	22.2
Public Administration (Government)	181,693	13.8
Non-Classified Establishments	88,800	6.7
Manufacturing	279,804	21.2
TOTAL:		

least-urbanized towns at the region's outer edge. In the last twenty years, farms have provided prime sites for residential development. Mining consists primarily of sand and gravel operations and a small amount of granite quarrying; these activities are generally located on the North and South Shores.

4.1.3 Land Use in the Boston Area

Development in this case study area has been heavily concentrated within the boundary created by the inner circumferential highway (Route 128)--about 15 miles from the City of Boston. The pattern of land development within this area is typical of many metropolitan areas, with an intensely developed urban core and development at decreasing densities further from the core. Data on the current supply of land is available from the University of Massachusetts' Remote Sensing Project[1] for 49 of the 92 communities in the case study area. This data indicates that about half of the 240,975 acres contained within these communities is either presently developed, or is pre-empted from development in the form of public or semi-public open space, deed-restricted wetlands, waterbodies or conservation zoning districts. The remaining land (about 266,619 acres) is available for future development.

The University of Massachusetts study shows that the pattern and intensity of land use changed significantly in the case study area between 1951 and 1971, following changes in the level and distribution of population and employment. Exhibit 4-5 summarizes the data available from this project for 40 communities. The largest decreases in agricultural and forested land occur (as could be expected) where population growth has been the highest--generally in the outlying communities to Boston's west and south. Much of the increase in residential land is due to the construction of single

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[1] William P. MacConnell & Marcia Cobb, Remote Sensing: Twenty Years of Change in Massachusetts, 1951 - 1971. University of Massachusetts, 1975.

EXHIBIT 4-5

AREAWIDE LAND USE CHANGES (40 COMMUNITIES)
1951 - 1971

USE	Number of Acres, 1951	Number of Acres, 1971	% Change
Residential	169,000	241,000	43%
Commercial/ Industrial	23,000	39,000	38%
Total Urban Land	192,000	280,000	46%
Agriculture	140,000	62,000	-56%
Forested Land	374,000	331,000	-11%

SOURCE: MacConnell & Cobb, op.cit.

family housing during this twenty-year period, although in the communities that permit them, apartment construction has also accounted for some increase. The communities closest to Route 128 show the largest increase in commercial/industrial land; much of this growth is attributable to the greater accessibility afforded by this highway and the newer Interstate to the west, I-495.

In general, the land uses which can be categorized as "urban" (residential, commercial and industrial) are found in those areas best served by major transportation routes and, for the most part, concentrated within areas that already supply urban services such as water and sewerage. The Metropolitan Water and Sewerage Districts serve practically all of the developed areas near Boston, as well as the older core cities. Pockets of development are served by smaller systems run by individual towns or by smaller regional districts; many individual communities have constructed small sewer systems for their town center.

Another general area of concentrated development is along the coastline. Both year-round and seasonal homes line the shores of outlying communities from Cape Ann in the north to Plymouth. There is an increasing trend in the conversion of summer homes to year-round residences, as transportation is now readily available to the core's employment centers. In Boston, the predominant type of waterfront development is industry, although the last ten years have seen the conversion of vacant and underutilized wharfs into residential and commercial areas.

Overall, land available for housing is limited in the Boston area. The large tracts of relatively inexpensive land needed for the development of single family subdivisions are now found only in the area's outlying communities. Even there, the historical pattern of small farms and villages leads to difficulties in assembling parcels, and to local governments with strong interests in each development proposal. The construction of multi-family projects is also frequently limited to areas where urban services are provided, and where land is sufficiently expensive to encourage more intensive uses. The short supply of land has prompted many communities to adopt ordinances which require the protection of natural features, and these too may limit the supply of land even further for some uses. Housing developments in the Boston area tend to be small by national standards (with fewer than 100 units) and tend to fill in between established urbanized areas rather than extending into previously undeveloped regions.

4.2 THE DEVELOPMENT PROCESS IN MASSACHUSETTS

The development of housing in Massachusetts is, as in the rest of the country, governed by several factors. In a simple view, there are three types of actors: housing consumers who need a place to live, developers who translate perceived consumer desires into dwellings for sale or rent, and the "government" which regulates the supply of land available for various activities. In Massachusetts, the regulation of land has traditionally been reserved for local governments--cities and towns. While in recent years this role has been somewhat circumscribed through participation by a number of state agencies, the ultimate responsibility for this type of regulation remains at the local level. In this section, the roles played by relevant agencies in housing production in the Commonwealth are described. Section 4.2.1 presents the community boards which are typically involved in reviewing and approving residential development proposals. Section 4.2.2 describes environmental reviews conducted by state agencies, and Section 4.2.3 presents the roles of Federal agencies that affect housing development in the Boston area.

4.2.1 The Local Review Process

In Massachusetts, four community boards and the office of building inspector are responsible for approving various aspects of housing development proposals. These boards and their responsibilities are shown in Exhibit 4-6. It should be noted that these Boards interact: a decision by one becomes part of a cumulative set of approvals.

EXHIBIT 4-6

RESPONSIBILITIES FOR LOCAL REVIEWS OF HOUSING DEVELOPMENTS

Community Authority	Typical Responsibility[1]
Planning Board	o subdivision of land o compliance with Community Water Plan o compliance with Community Zoning Ordinance
Board of Zoning Appeals	o approval of zoning variances, change in zoning classification, or special permits
Board of Health	o compliance with State sanitary code, regulating installation of wells and on-lot wastewater disposal
Conservation Commission	o compliance with Wetlands Protection Act, review of actions affecting inland and/or coastal wetlands (e.g., storm runoff, dredging, or filling activities, etc.) purchase and maintenance of conservation land.
Building Inspector	o compliance with Building, Electrical and Plumbing Codes

[1] There is not complete uniformity from community to community.

Planning Board

Each community generally follows the same process for reviewing development proposals. This process is outlined in Exhibit 4-7. The number of days allotted to each step at the margin of this exhibit describes the process for a suburban town to the south of Boston. By-laws in many communities do not specify the maximum amount of time allowed for each step, although in some communities this is mandated by local ordinance.

The Planning Board's primary responsibility is the regulation of land subdivision. At a minimum, the review of subdivision proposals is directed at ensuring that public health and safety can be protected in the new development. These reviews examine the design and construction of streets and public ways, outdoor lighting, provision for water and sewerage service (whether privately or publicly provided), storm drainage, and flood control, among other things. Each community adopts regulations which specify minimum standards for subdivision proposals. These regulations typically require that the Planning Board hold a public hearing before deciding whether or not to approve a proposal. In practice, reviews are often conducted somewhat informally. Meetings with developers can result in modifications to the proposed site plans and developers usually have some sense of what the Board will or will not approve. However, there is always a formal record of review for the Board's final decision.

The Planning Board is also responsible for the development of a comprehensive plan which should direct growth according to community goals. In support of this plan, the Board may prepare special studies (usually undertaken by the community's planning office or a private consulting firm) of the community's resources and needs. While most communities in the Commonwealth have prepared these master plans, many are now out-of-date, and are frequently not used formally in reviewing individual development proposals.

EXHIBIT 4-7

SUBDIVISION APPROVAL PROCESS

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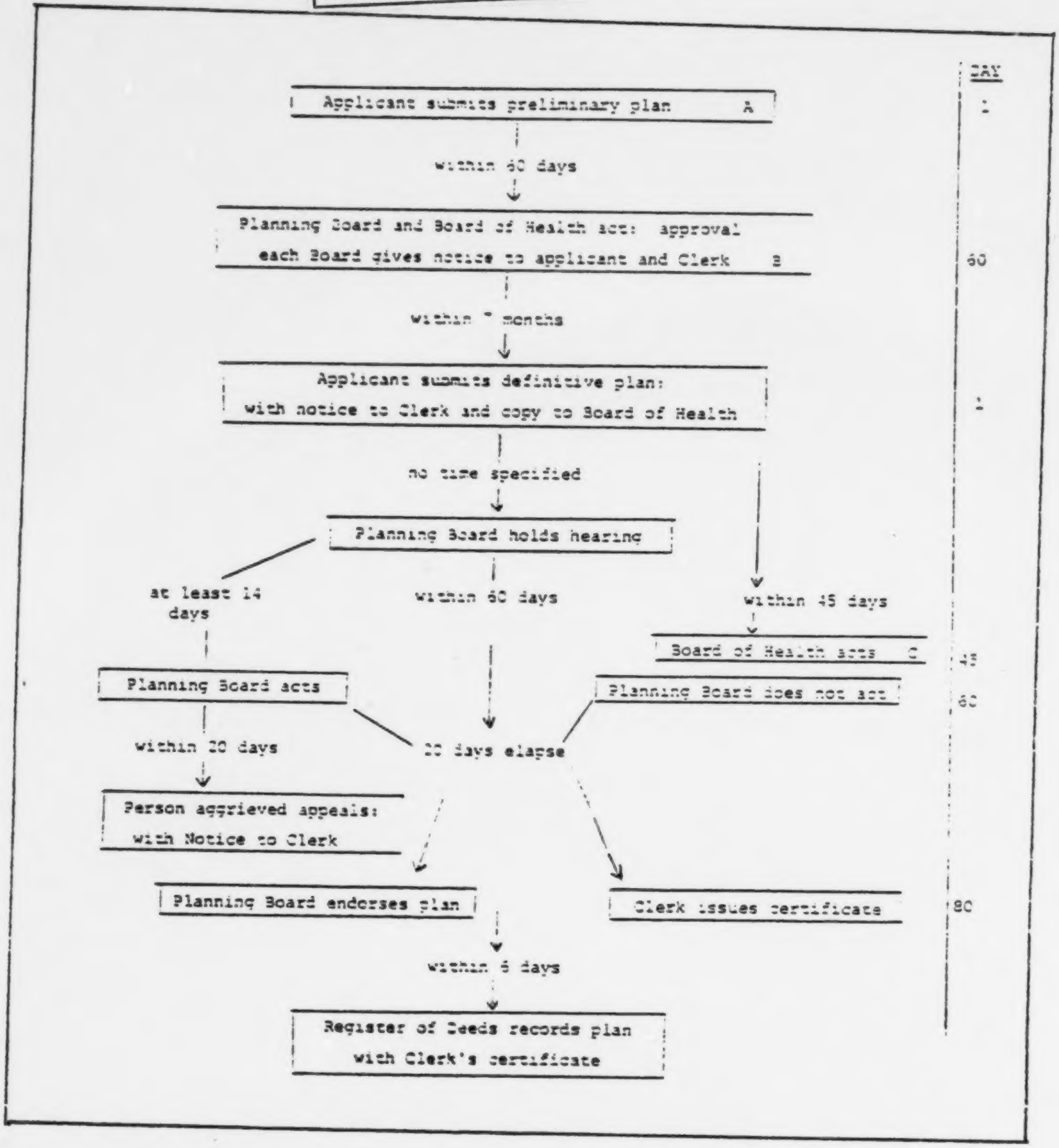
DAY
Applicant submits preliminary plan A
1
within 60 days
Planning Board and Board of Health act: approval
each Board gives notice to applicant and Clerk B
60
within 7 months
Applicant submits definitive plan:
with notice to Clerk and copy to Board of Health
1
no time specified
Planning Board holds hearing
at least 14 days
within 60 days
within 45 days
Board of Health acts C
45
Planning Board acts
Planning Board does not act
60
within 20 days
20 days elapse
Person aggrieved appeals:
with Notice to Clerk
Planning Board endorses plan
Clerk issues certificate
80
within 6 days
Register of Deeds records plan
with Clerk's certificate

Source: Massachusetts Executive Office of Communities and Development, Compendium: Developing a Coordinated Local Permitting System, April 1979, p. 33.

Board of Zoning Appeals

A zoning ordinance regulates the height and bulk of buildings and the use of land in a community. The zoning by-law contains a set of regulations specifying limits for attributes of development in each type of zone, as well as a map which delineates zones in the community. The regulations may be written as prescriptive requirements specifying maximum activity levels, or they may be written as performance standards. Some activities may be allowed within certain zones only with a special permit: for example, an apartment development in an area zoned for single-family residential use.

The Board of Zoning Appeals is charged with approving changes to this ordinance. These changes can be comprehensive, as in a complete revision of the by-law. More frequently they are incremental, through the granting of individual zoning changes for projects, variance from the height or bulk restrictions or special permits for uses. The zoning ordinance typically establishes procedures for the Board's review of development proposals, including maximum time periods allowed for the review and requirements for public notification of proposed changes and public hearings. A development proposal which does not require a variance from the existing zoning regulation or a special permit is not usually reviewed by this Board. In these cases, the Planning Board may certify that the proposal conforms to the applicable zoning regulations. However, many projects require some type of variance.

Board of Health

This Board is responsible for ensuring that new development meets the requirements of the State Environmental Code, which specifies acceptable conditions for the provision of drinking water and the disposal of wastes. This Board must approve the location of wells and septic systems on each lot in a subdivision which relies upon these methods of providing services. Plans for tying into the community's water and/or wastewater disposal systems must also be approved by this Board.

Developers must submit plans for wastewater disposal systems to this Board. As shown in Exhibit 4-7, this is typically done at the same time that the initial project plans are submitted to the Planning Board. For developers relying on on-lot methods of wastewater disposal, plans for each system must be submitted with soil percolation tests. In approving these plans, the Board must consider several factors:

- size and shape of the lot,
- natural and adjusted drainage patterns,
- distance from existing and known future water supplies,
- depth to groundwater, and
- presence of impervious or highly permeable soils.

Communities may establish criteria for waste disposal that are more stringent than those contained in the State Environmental Code. Many of the outlying communities in the Boston area have chosen to do so, in order to protect their groundwater resources as well as water quality.[1]

Conservation Commission

The primary purpose of Conservation Commission reviews of proposed housing developments is the protection of the community's wetlands. Permission of this Commission is required for any alteration (including dredging or filling activities) of stream beds or banks, as well as estuaries, beaches, marshes or swamps. Exhibit 4-8 describes the process mandated by state law[2] for review of development proposals by the community's Conservation Commission. Requirements for mitigating adverse impacts are imposed upon a developer by the Commission's Order of Conditions, which specifies

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[1] Or, for other reasons. Many of these criteria involve large minimum lot sizes.

[2] Wetlands Protection Act of 1972, Chapter 784, Massachusetts General Laws of 1972.

EXHIBIT 4-8

CONSERVATION COMMISSION APPROVAL PROCESS

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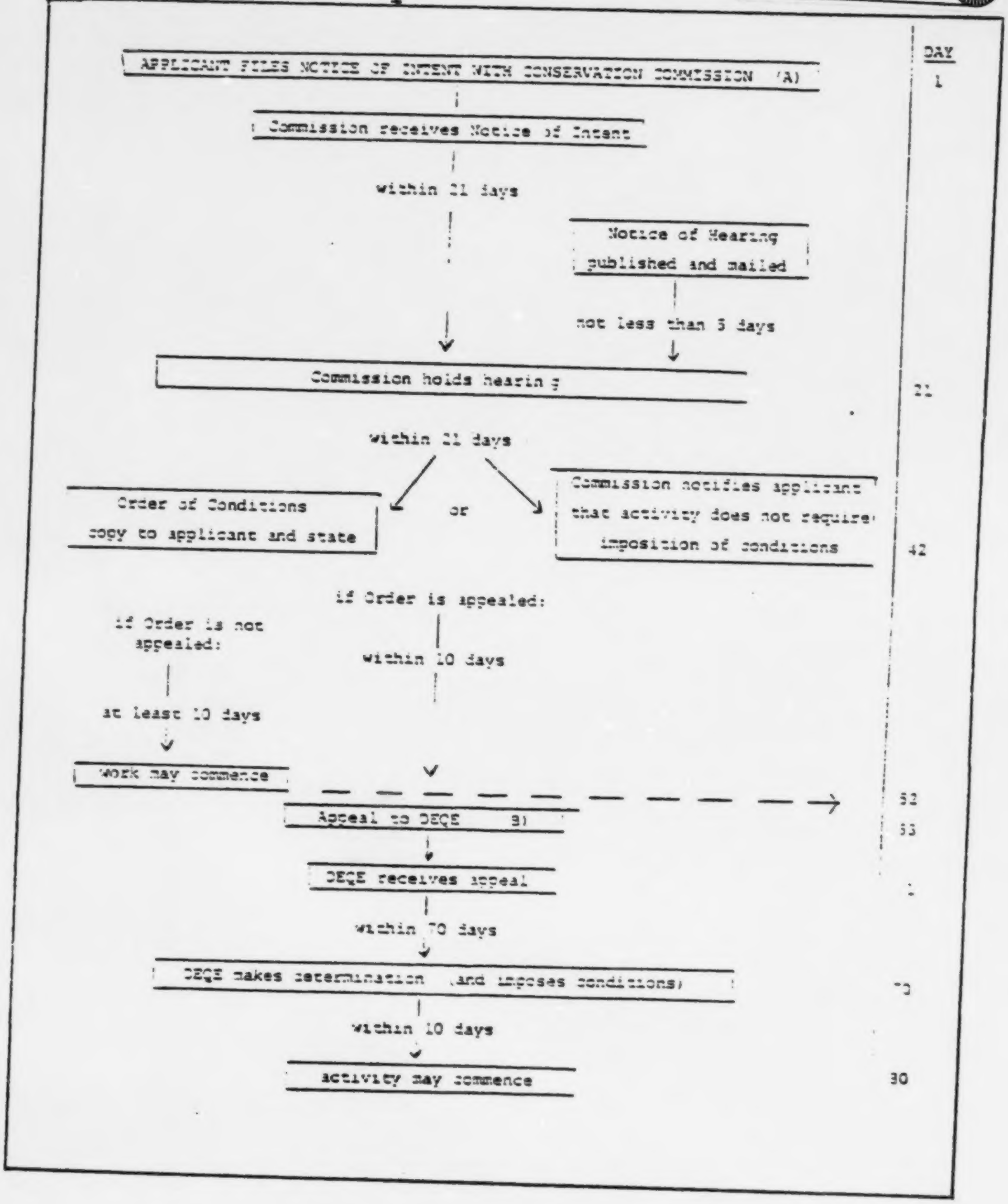
DAY
APPLICANT FILES NOTICE OF INTENT WITH CONSERVATION COMMISSION (A)
1
Commission receives Notice of Intent
within 21 days
Notice of Hearing published and mailed
not less than 5 days
Commission holds hearing
21
within 21 days
Order of Conditions copy to applicant and state
or
Commission notifies applicant that activity does not require imposition of conditions
42
if Order is not appealed:
at least 10 days
work may commence
if Order is appealed:
within 10 days
52
Appeal to DEQE (B)
53
DEQE receives appeal
1
within 70 days
DEQE makes determination (and imposes conditions)
70
within 10 days
activity may commence
80

Source: Massachusetts Executive Office of Communities and Development Compendium: Developing Coordinated Local Permitting System, April 1979, p. 33.

actions that are to be taken during construction (to minimize erosion) or changes to the project design that will protect these environmentally sensitive lands. The Conservation Commission is required to hold a public hearing before issuing its Order of Conditions.

Appeals of the Order may be filed with the state Department of Environmental Quality Engineering within ten days of its issuance. Appeals may be filed by the developer (usually protesting the stringency of the regulations) or by the project's neighbors or community residents (usually protesting the Order's leniency). While the state agency is statutorially supposed to rule on appeals within 70 days, resolution frequently takes much longer. This may be due to the need to prepare hydrologic studies of the project area; it may also be due to a lack of staff at the state agency.

Building Inspector

A community's Building Inspector must review plans for individual buildings to ensure that they conform to the community's Building, Plumbing and Electrical Codes. A building permit must be obtained in order to start construction. In addition to the plan reviews, inspections are usually made during construction and once the building is finished to ensure that plans were followed. In some communities, the Building Inspector is also allowed to refuse a permit for a development which is not considered to be in the public interest. As one of the cases illustrates, this type of refusal can be challenged in court; several refusals have been overturned.

In recent years, some communities have revised their codes to encourage the conservation of resources. Most notably, codes have been revised to encourage water conservation through the installation of low-flow plumbing devices. Energy conservation has also been a focus of code revision, with new requirements for increased insulation and energy-efficient appliances. While these factors were not important in the four housing developments described in Section 4.3, developers indicated that they can be expected to increase the cost of building housing in the future.

4.2.2 Project Reviews at the State Level

In Massachusetts, state agencies are involved in several aspects of the housing development process. Some agencies are directly responsible for implementing Federal environmental mandates--for example the Federal Clean Water and Clean Air Acts. Other agencies are responsible for reviewing the environmental impacts of a project upon its surroundings. Still other agencies are empowered to hear and decide upon appeals of the decisions of local Boards. Finally, at least one agency provides water and sewerage service to most of the communities in the Boston metropolitan area.

Most of the state agencies that are concerned with environmental issues surrounding housing development are located within the state's Executive Office of Environmental Affairs. This "secretariat" includes the agencies responsible for environmental permits and planning, impact reviews, and the provision (at the state level) of water and sewerge services. Other agencies which are involved with the provision of subsidies for housing projects and with the provision of technical assistance for housing-related planning are located within the Executive Office of Community Development. This section describes these agencies in terms of their roles in the process of residential development.

Implementation of Federal Environmental Mandates

Several agencies within the Executive Office of Environmental Affairs are responsible for implementing requirements of Federal environmental legislation. The Department of Environmental Quality Engineering's Division of Water Pollution Control issues permits (with EPA) for discharges of wastewater to the Commonwealth's streams. The Division supervises the state's participation in EPA's Construction Grants program, and is responsible for allocating reserve capacity in sewerge systems which do not meet standards for effluent quality or quantity. The Department, through its Regional

Engineering Offices located throughout the state, also regulates the siting of on-lot and package wastewater disposal systems, septage disposal, and sludge management. Proposals for housing projects which involve discharges of more than 10,000 gallons of wastewater per day must obtain approval of the Regional Engineer. The Division of Water Supply must approve plans for withdrawals of water for a community drinking water system.

In addition, the Department of Environmental Quality Engineering is responsible for the preparation of plans documenting the Commonwealth's approach to attaining Federal environmental standards for air and water quality. These plans are based upon assumptions about the location, pace and timing of growth throughout Massachusetts. An example of this type of planning is the Areawide Water Quality Management Project[1] in which the actual planning for the Boston area was done by the regional planning commission, subject to approval by the Department of Environmental Quality Engineering. The Department also prepares the state's air quality management plan although this planning effort has not had a direct impact upon housing development in the Commonwealth.

Environmental Impact Reviews

Two state agencies review the environmental impacts of housing projects. Both work directly under the Secretary of the Executive Office of Environmental Affairs. One office administers the Massachusetts Environmental Policy Act, which is modeled after the National Environmental Policy Act. This office circulates and reviews Environmental Notification Forms filed by developers, and determines whether a full-scale Environmental Impact Report (EIR, the state equivalent of an Environmental Impact Statement) is warranted. An EIR may be required when a project is sufficiently large to exceed specified thresholds--in the case of a housing development, when it contains more than 300 dwelling units. In addition, an EIR may be required if a project is located in or near an environmentally-sensitive area, as evidenced by comments received in the Environmental Notification Form. EIRs are prepared by developers and reviewed and approved by this state office. Most of the EIRs to date have been prepared for state construction projects or for large commercial or industrial developments. By the middle of 1980, only one EIR had been prepared on a housing development; this project is the subject of Case B, described in Section 4.3.1.

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[1] Mandated by Section 208 of the 1972 U.S. Clean Water Act (P.L. 92-500)

The state's Coastal Zone Management Agency, which is also located directly under the Secretary of the Executive Office of Environmental Affairs, reviews the impacts of proposed developments upon the Massachusetts coast. Housing proposals are reviewed only if they meet at least one of three conditions:

- any project that is located within the coastal zone and requires a Federal permit. Only projects that exceed the threshold for review under the Massachusetts Environmental Policy Act are reviewed. The Coastal Zone Management Office can veto a project if it is inconsistent with the Coastal Zone Management Plan;[1]
- any project involving the use of public funds by a state or local agency; or
- any project involving other Federal activities.

These criteria have been formulated in such a way as to give the agency broad discretion over what it chooses to review. To date, only one housing project has been reviewed. There are two reasons for this:

- this agency has preferred to concentrate its limited resources on large-scale industrial activities.
- the Coastal Zone was defined to encompass land one mile inland from the mean high water mark, and most of the land in the zone is already developed.

Therefore, this agency is not a major actor in the housing development process, although it could be more active in the future.

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[1] Adopted in 1978 by the Commonwealth.

State Appeals Agencies

Two state agencies have authority to hear appeals of local governments' development decisions. One agency in the Department of Environmental Quality Engineering hears appeals of Orders of Conditions promulgated by local Conservation Commissions. As noted in Section 4.2.1, these appeals must be filed within ten days of the order's promulgation. The state agency is supposed to make a final determination within 70 days. However, this review frequently takes longer as new hydrologic data must be developed, and as the agency tends to be understaffed. It is common to see Orders of Conditions appealed to this agency. Interviews indicate that this process (and the slow speed with which the state acts) are a major cause of delay for many types of development.

The second appeals agency is not directly involved with environmental issues. The Department of Community Affairs hears appeals of zoning decisions under the Commonwealth's "anti-snob zoning" legislation.[1] This law allows a developer of subsidized hous- ing for low and moderate income people to appeal a rejection of the plan. In an appeal, the developer must provide evidence that the community does not contain its share of housing for low and moderate income people, that the development is needed, and that it will not pose an undue burden on community services. The Department of Community Affairs has the authority to issue a comprehensive permit which supercedes the local government's refusals. While this is not strictly an appeal on environmental issues, it does provide a developer an opportunity to obtain approval for subsidized housing where local opponents of the project are using environmental regulations (such as large lot requirements or requirements for particular methods of waste disposal) to prohibit development. Case B1 is an example of this situation, as described below.

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[1] Massachusetts General Laws, Chapter 40B, Sections 20-23.

Services Provided by the State

In the Boston area, the regional water and sewer district is a state agency, operating under the Executive Office of Environmental Affairs. The Metropolitan District Commission is a wholesaler of water and sewerage services to 43 communities in Eastern Massachusetts. Essentially the community provides a local distribution and collection network, while the Metropolitan District Commission delivers water to the community from its reservoirs in Western Massachusetts, and collects and treats wastewater at two plants in Boston Harbor. Capacity in these systems has not generally been a problem in the past, as system expansion has closely followed population growth. However, in some of the region's fastest growing areas, the capacity of some sewerage system components (such as interceptors) is limited, and the Commission has imposed several moratoria on new connections until capacity becomes available.

The capacity of the Commission's water system has not yet been an issue, although by statute the Commission must provide service to all communities within 15 miles of the State House. Some of the Metropolitan area's most rapidly growing communities are at the fringe of this service area, and are not yet served. There may be moratoria on new water hook-ups for individual developments as more communities want to join the Metropolitan Water District, since there has been no significant increase in reservoir or distribution pipe capacity in some years. However, this has yet to affect the development of individual projects. In non-MDC communities, a lack of water has prevented development in several instances.

Housing Subsidies

The only state agency that is directly involved with the development of new housing is the Massachusetts Housing Finance Agency. This agency disburses funds from the U.S. Department of Housing and Urban Development for the construction of housing for families with low and moderate incomes. This agency participates in the state's environmental impact review process, and recommends the need for preparation of an Environmental Impact Report on an individual project.

Federal Involvement

Federal agencies are not generally participants in the planning and review of specific housing developments. Several agencies do oversee the implementation of Federal environmental mandates. These are summarized in Section 3 above.

The one exception is the Department of Housing and Urban Development (HUD), which in some cases provides subsidies or mortgage insurance directly to individual developments. Project designs are reviewed by the Area Office of the Federal Housing Administration, which must ensure consistency with HUD's Minimum Property Standards. In addition, the Area Office's staff also screens the potential environmental impacts that a project may cause, to comply with the National Environmental Policy Act, as described in Section 3 above. In cases where a state Environmental Impact Report is being prepared (or has already been filed) then HUD will waive a requirement for a Federally prepared Environmental Impact Statement.

4.3 CASES IN THE BOSTON METROPOLITAN AREA

The development histories of four housing projects were researched in some detail to provide data on the actual impact of environmental regulations upon housing costs. These cases were selected in a two step process. In the first step, the regulations adopted by the communities in this metropolitan area were reviewed and the communities with the most stringent local ordinances identified. These ordinances covered a variety of environmental concerns:

- large lot zoning (communities with at least one residential zone specifying minimum lot requirements greater than one acre,
- development controls or restrictions in the 100 year floodplain,
- on-site wastewater disposal regulations that are more restrictive than the minimums specified in the state's Sanitary Code, and
- controls governing erosion, run-off and stormwater drainage.

This review relied upon an initial survey of communities participating in the Areawide Water Quality Management Project in the greater Boston Area. The inventory was verified and expanded through interviews with community planning officials and building inspectors. These interviews also provided information on the pace of development in each community--i.e., the number of units and developments that had been completed or were under construction in 1979 and the first five months of 1980.

The inventory was expanded to include Federal and state reviews of housing developments, in the areas of:

- environmental reviews (projects for which a Federal Environmental Impact Statement or state Environmental Impact Report had been prepared),
- communities which had recently increased their sewerage capacity,
- residential developments categorized as generators of air pollution through increases in traffic (no residential developments had been reviewed under the state's mobile source regulations, so this indicator was dropped), and
- residential developments reviewed by the Massachusetts Coastal Zone Management Office.

In addition, the number of Federally subsidized dwellings (and projects) constructed in each community in 1979 and the first five months of 1980 was also obtained.

This information was arrayed in a matrix (presented in Appendix B) showing the level of activity for each attribute in all of the communities in the Boston Metropolitan area. From this matrix, seventeen communities were chosen for the second step of the selection process. The communities selected were those in which development was occurring, and whose regulations ensured that a particular project would be reviewed with respect to its environmental consequences.

It should be noted that the communities which contained the most Federally-subsidized development were generally the area's older cities, where the environmental regulations are not as stringent as in outlying suburbs. This matrix also provided evidence of the pace of growth: the communities with the most stringent environmental controls frequently do not provide urban services such as water and sewer, and exhibit the least amount of development--generally only a few dwellings in one or two developments in a given year. The communities selected for further study fell into a middle group: they had environmental regulations that were sufficient to affect the design and construction of housing, and enough development to allow a choice between projects.

The second step in the case selection process involved the identification of specific housing developments in the seventeen candidate communities. This was accomplished by contacting the Massachusetts Homebuilders Association, an affiliate of the National Association of Homebuilders. Through the Massachusetts group, access to developers was facilitated. Through conversations with developers, the candidate list of projects was narrowed to four.

Several interviews were conducted for each case. The developer was interviewed at some length (a copy of the interview guide can be found in Appendix C) and documents pertaining to the project were reviewed. In addition, the state, local and Federal review records were used to document statements and to provide background materials on each case.

In the rest of this section, a brief development history is presented for each of the four Boston cases. The costs involved in complying with environmental regulations are noted. An analysis of these costs and those found in the Dallas cases is presented in Chapter 6.

Case B1

Case B1 is a Federally subsidized multi-family development nearing completion in an older suburb on Boston's North Shore. The project is being constructed on a 25 acre site near the town center. When complete the development will contain 266 units (divided among thirteen buildings) and a clubhouse containing recreational facilities, tennis courts and a swimming pool. Of the 266 units, 180 are reserved for the elderly, and an additional 27 are specially equipped for handicapped people. The units range in size from one to three bedrooms, with contract prices ranging from $450 to $655 per month (actual rents for subsidized units will be somewhat lower). The development company employs some 75 people, of whom 50 manage completed residential projects.

Planning for this project took place over a period of almost ten years, but did not substantially change the project's original physical concept. In 1971, the developer signed a Purchase and Sale Agreement for the 25 acre site, with a stipulation that the deal would be closed upon receipt of a building permit. The parcel had once been used partially by a small manufacturing firm but was then vacant. The purchase price for the land was approximately $266,000, or about one-half its appraised value as industrial land.

Immediate improvements to the site were needed. These included a sewer connecting the parcel with the town's collection system. In 1972, the developer agreed to build the 1000' connector at a cost of some $14,000.

A site plan for luxury condominiums was submitted to the Town Planning Board in February, 1973. The plan was approved in April, 1974. During this period, the Board's engineering consultant reviewed the preliminary plan, and suggested some minor changes in road layout and drainage. These changes were made by the developer, who considered them to be "insignificant". Part of the site was a wetland, and in 1973 the developer filed an application for approval of the Town Conservation Commission to include this area in the development. The Conservation Commission approved the application almost immediately, with a stipulation that a 3-acre section not be built upon. This approval was renewed on a yearly basis in 1974, 1975, and 1976.

By the end of 1973, the market for condominiums in the Boston area had weakened. Since the developer had some difficulty in selling units in other completed projects, an application for Section 8 financing (from the U.S. Department of Housing and Urban Development through the Massachusetts Housing Finance Agency) was prepared for Case B1. This application was made as insurance in the event that the original marketing plan for luxury apartments was infeasible, and for the next year, the project's financial planning proceeded on dual tracks. By the end of 1974, a decision to proceed with a subsidized housing project was reached.

Once the developer decided to use Federally-subsidized financing, an Environmental Notification Form was filed with the Massachusetts Housing Finance Agency, in compliance with the Massachusetts Environmental Policy Act. In August, 1975, MFHA decided to require the preparation of an Environmental Impact Report for B1: although the state had not established threshold project sizes for residential developments, the agency responsible for environmental reviews based its decision on the size of the proposal, which was larger than most residential projects undertaken in the state. Preparation of the final Environmental Impact Report took about two and one-half years (including submittal of a draft). The final report was approved in February 1978.

During the two and one-half year period in which the Environmental Impact Report was being prepared, difficulties in obtaining a building permit affected the project's progress. After the project had obtained the necessary Planning Board approvals, the Town Building Inspector would not issue a building permit. The developer sued in Land Court under the Commonwealth's "Anti-Snob Zoning Act"[1], which allows the state Department of Community Affairs to issue a permit allowing construction of housing for families of low and moderate income if local regulations are too restrictive. The Court ordered the Department of Community Affairs to issue the overriding permit, ruling that the Building Inspector could not refuse a permit because the proposed development would constitute a "neighborhood nuisance". The Town challenged this ruling in the State Supreme court, which refused to hear the case. Even after the Town's appeals were turned down, the Building Inspector refused to issue the necessary permit. Finally, the developer appealed to the state's Housing Appeals Court, which directed the Department of Community Affairs to issue an overriding permit.

An additional problem arose in 1977, just as the building permit issue was about to be resolved by the court. In this year, the Town Conservation Commission decided not to renew the project's Order of Conditions concerning construction in the wetlands portion of the development, which had been reissued routinely since 1973. The Conservation Commission argued that the development's plans had changed sufficiently to warrant a resubmittal of the application. After a meeting with town officials, and staff of the state's environmental regulatory agencies, the developer agreed to resubmit the project's application.

In early 1978, the Conservation Commission ruled that the project area's storm drainage system was inadequate, and that drains under the nearest major city street would have to be rebuilt to accommodate storm drainage from B1. The Commission also requested that the developers arrange to have a brook located downstream (and off the project site) cleaned to facilitate storm flows. Abutters of the project filed a class action suit claiming that the Conservation Commission's conditions did not provide adequate protection. The developer appealed these conditions to the state regulatory agency (the Department of Environmental Quality Engineering). In October 1978, the agency ruled in the developer's favor, but required a compromise in which the developer could construct a retention pond for storm drainage, with a small dam. Later in 1978, the developer was able to demonstrate that the pond was not necessary, and the state agency dropped the requirement.

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[1] Massachusetts General Laws, Chapter 40B, Sections 20-23.

One more issue remained to be resolved before construction could start. After the developer paid for the construction of a sewer connecting the development with the Town's system, the Town refused to allow the development to tap into the main line. The town argued that a pump station near the development was operating at capacity, and there was no additional capacity available for new flows. The developer appealed the Town's decision to the state Division of Water Pollution Control. In June 1978, the Division placed a ban on connections to the town's sewerage system until an infiltration/inflow study could be prepared. This study was completed in early 1979, and showed that some reserve capacity was available at the pumping station. The Town was required to allocate the reserve capacity on a "first-come-first served" basis, and the B1 developers had priority over others waiting for this capacity. In June 1979, the Division of Water Pollution Control directed the Town to permit this development to tap in.

Once the sewerage issue was resolved, and the building permit was obtained (from the state Department of Community Affairs), the developer took title to the land which had been under option since October 1971. Title to the land was finally transferred to the developer in September, 1979, and construction started immediately.

Some planning delays were caused by changes in regulations with which the project had to comply, such as the decision to require an Environmental Impact Report after financing had been committed. Other delays could be attributed to local opposition to a subsidized housing project. Local officials and the development's prospective neighbors used the local and state regulatory process to oppose the project.

Case B2

Case B2 is a recently completed subdivision of single-family homes in a rapidly-growing Boston suburb. The project's 39-acre site is located adjacent to a state highway. Lot sizes in the subdivision ranged from 15,000 square feet to more than three acres. House prices range from $45,000 for a three-bedroom unit to $102,000 for a four-bedroom unit on one of the development's largest lots. Thirty-four of the development's thirty-nine units were sold prior to the start of construction.

The developer purchased the entire vacant parcel early in 1977. The parcel was already zoned for single family housing. A previous owner had obtained approval of a subdivision plan from the town Planning Board, as well as permission from the (former) State Department of Natural Resources to build in a wetland. The developer submitted a revised site plan to the Planning Board soon after he acquired the property.

The Planning Board required several changes in the project's site plan. The Town's zoning ordinance prohibited construction within the town's 100-year floodplain (this provision was enacted after the former owner had obtained approval of the parcel's first site plan). The developer was required to delineate the 100-year floodplain with respect to this parcel, and to raise the bed of the subdivision roadway by 3" so that it would be elevated above this floodplain.

In addition, the developer was required to improve storm drainage in the project area. Two 42" drain pipes were installed at the project site, and a small brook was rerouted to provide additional drainage capacity from the project. The latter measure was chosen because easements for additions to the town's storm sewers were not available from abutters. A revised site plan containing these changes was submitted at the beginning of April, 1977. It was approved by the Planning Board at the end of that month.

In June, 1977, the developer applied to the state for permission to have the community's sewer lines extended to the project site. The Massachusetts Department of Environmental Quality Engineering, which was concerned because the town's sewerage system was close to its capacity, reviewed the developer's feasibility study. The sewerage permit was granted at the end of September, 1977.

The previous property owner had submitted an Environmental Notification Form to comply with Massachusetts' Environmental Policy Act. In November 1975, the state concurred that the project would not result in any adverse environmental impacts. Other environmental reviews were undertaken by the Town Conservation Commission as part of the subdivision review. This Commission required the submittal of bi-monthly reports on construction progress and its impact on adjacent wetlands. Another review was also made by the Town's Landscape Review Committee, which recommended to the Planning Board that the proposed site plan be approved.

The developer incurred some costs in complying with the necessary environmental regulations. The storm drainage work totaled $137,000: $100,000 for the installation of two 42" drainage pipes and another $37,000 for rerouting a small brook. In addition, some time was lost in attempting to obtain drainage easements from abutters, and this was not quantified. The cost of elevating the subdivision roadway by 3" was approximately $75,000, and the hydrologic study delineating the 100 year floodplain cost approximately $7,000. Costs were also incurred in connection with the sewerage extension permit: the feasibility study cost about $3,500, with a $75 permit application fee. Finally, the developer estimates that carrying costs on the parcel (taxes and insurance, primarily) amounted to about $50,000 over the two-year period in which all of the necessary approvals were obtained. The prices of the units which were not sold prior to the start of construction were raised by an unspecified amount to cover some of these unexpected costs.

Case B3

This project entails 600 condominium units on a 60 acre parcel in an outlying suburb west of Boston. Plans call for the construction of a commercial strip along the town road bordering the site, as well as a small light industrial park. Construction has begun for the commercial areas and for 172 of the 600 condominium units. The condominiums are housed in low-rise buildings, each containing four units. All units have the same floor plan and contain two bedrooms. Selling prices range from $48,900 to $65,000 for a unit with air conditioning and a finished basement. The development company is one of the largest in the Boston area. At the time that this case was researched, Case B3 comprised approximately one-third of the dwelling units that this company had under construction.

The developer purchased the 60-acre parcel in 1976. A preliminary site plan for the proposed devlopment was submitted to the town in December, 1977, and approved eleven months later. A final site plan was submitted to the town in January 1979, and approved in April 1979. The final plan was reviewed by the Town Conservation Commission concurrently with the Planning Board's review. The Conservation Commission's Order of Conditions was incorporated into the final plan approval.

This project encountered two major stumbling blocks in complying with relevant environmental regulations. The first involved a moratorium of sewer connections in the project's town and two adjacent communities. All three communities are provided sewer service by the Metropolitan District Commission. In 1977, the interceptor which connects these three communities to the rest of the metropolitan sewerage system was being used to its capacity. At times of peak flows, the interceptor would leak, discharging raw sewage directly to the Charles River. While plans were being drawn up to correct the problem, the Metropolitan District Commission imposed a moratorium on new connections, to avoid exacerbating overflows at peak periods. In 1979, a chemical plant in B3's community closed, easing the burden on this interceptor. The B3 development was first of several projects waiting for sewer capacity, and so was granted the necessary permit to discharge up to 400,000 gallons of sewage per day. This permit was approved in Fall, 1979.

A second major obstacle arose over the state's environmental review requirement. Construction started on the first group of 88 units at the beginning of February, 1980. At the end of that month, the regulations that specify projects for which an Environmental Impact Report must be prepared were changed. A project size threshold of 300 dwelling units was included in the new regulations. The developer appealed the new requirement to the state office which administers this review. In April 1980, the project was granted a limited waiver, which required the preparation of an impact report on the 522 units still in planning stages, and limited the issues to be reviewed to traffic generated and the sewer question. The Environmental Impact Report was completed at the end of Summer 1980, and construction is proceeding. While the environmental review was being prepared, construction of the first set of condominium units was proceeding. However, while the developer waited for sewerage capacity to become available, only planning work could continue.

The developer incurred several costs in meeting environmental requirements. First, the developer estimates carrying costs to have been approximately $105,200. This included $5,000 for property taxes on the unimproved land, $200 for insurance, and $100,000 for interest on the land loan (calculated at 1 1/2 percentage points over the prime rate). In addition, a study of sewage and traffic generated by the project required by the Town Planning Board cost approximately $50,000. Finally, the preparation of the Environmental Impact Report cost approximately $20,000. The developer indicated that these costs have not been passed on to purchasers of these condominium units.

Case B4

This development is a subdivision of 65 single-family homes in a rapidly growing suburb near Cape Cod. The three and four bedroom units are on lots ranging in size from 20,000 to 50,000 square feet. Sales prices for these houses are in the $65,000 to $70,000 range. Twenty-eight of the 65 homes have been completed. This development is located in the builder's home town and this tended to smooth the project's way through the review process.

The 45-acre vacant parcel was purchased for $50,000 in 1969. Several improvements were required in order to subdivide the property. The developer was required to provide individual on-lot septic systems, an access road within the subdivision,and drinking water service. The first preliminary site plan for a 75-unit development was submitted to the Town Planning Board in March 1972. Six months later, the Planning Board approved the developer's submission, with the added requirement that the project design include a storage area for surface water drainage. This approval was good for seven years: the developer either had to commence construction within this period, or reapply for Planning Board approval.

In 1972, the market for single-family housing began to slacken and the developer decided to delay this project for some time. By 1976, economic conditions had improved,and the developer submitted a revised site plan to the Planning Board. The most significant change was a reduction in the number of units--the revised plan showed only 65 lots that could be built upon. In addition the roadway design was modified slightly. The Town's engineering consultants argued that the original storage area for surface water runoff should be redesigned to facilitate management of stormwater. The developer was able to convince the Planning Board that this change was uneconomical. A compromise was worked out where the developer agreed to construct an open ditch drainage area for surface water runoff.

Another issue was resolved with the Conservation Commission's review of the project. The Commission was concerned about the location of five lots in the 100-year floodplain. However, the developer indicated that those portions of these lots which were located in the floodplain would remain undeveloped, and that the houses would be built at elevations higher than the 100-year storm elevation.

Review of the second site plan took approximately four months. The Town's final approval of the project was granted in February 1977. Construction started shortly thereafter.

The only unanticipated cost associated with the Town's environmental regulations was that of construction of the storage area for stormwater runoff. This cost the developer approximately $25,000.

CHAPTER 5

CASE STUDIES: THE DALLAS-FORT WORTH METROPOLITAN AREA

5.0 INTRODUCTION

The contrasts between the Boston and Dallas case study areas could hardly be more striking. While Boston can be considered typical of the old, stable cities of the East, Dallas is the prototype of the booming Sunbelt city. The surge in population triggered by the Texas climate and the Southwest's general business expansion has set off a torrent of residential construction quite unlike anything seen in New England. In contrast to Boston's small infill developments, Dallas' residential projects can involve several thousand units on huge tracts of land. Equally disparate are the commonly voiced perceptions of attitudes toward development; Boston is seen as a highly regulated anti-growth region while Dallas is often labeled a laisse-faire developer's haven.

This chapter presents the findings of five case studies in the Dallas area. The discussion begins with a brief description of background conditions: population growth, local development review procedures, and key state and federal agencies. The chapter concludes with descriptions of each of the five residential case studies.

5.1 BACKGROUND

The Dallas case study area covers the 11-county Dallas-Fort Worth Standard Metropolitan Statistical Area (See Exhibit 5-1). This region is one of the major growth centers of the Sunbelt and the level of development has increased explosively in the last two decades. In the 1960s the region's population grew by 37% to 2.4 million; by the end of the 1970s, the growth rate had fallen to an estimated 17% per decade, but the regional population had reached 2.8 million.[1]

All of the counties in the region have experienced rapid growth over the last 10 years, as is shown in Exhibit 5-2. Although the two core cities of Dallas and Fort Worth continued to record large population increases, their share of regional population is estimated to have fallen from 52% to 43% in the 1970s.[2] The greatest growth occurred in the suburbs north of Dallas and in the corridor between Dallas and Fort Worth.

The rapid population increases have been accompanied by residential construction on a massive scale. Between 1970 and 1978, 290,000 building permits were issued in the region, representing an increase in the housing stock of nearly 40%. Approximately 55% of these permits were for single family homes and 41% for multi-family units.

Housing developments in the Dallas area tend to be much larger than in Boston. In Dallas, projects larger than 500 units are common. Large, undeveloped sites are found much more frequently in Dallas than in Boston and development is less likely to be constrained by wetlands or steep slopes.

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[1] 1980 Rand-McNally Commercial Atlas.

[2] Current Population Estimates 1980. North Central Texas Council of Governments.

EXHIBIT 5-1

DALLAS CASE STUDY AREA

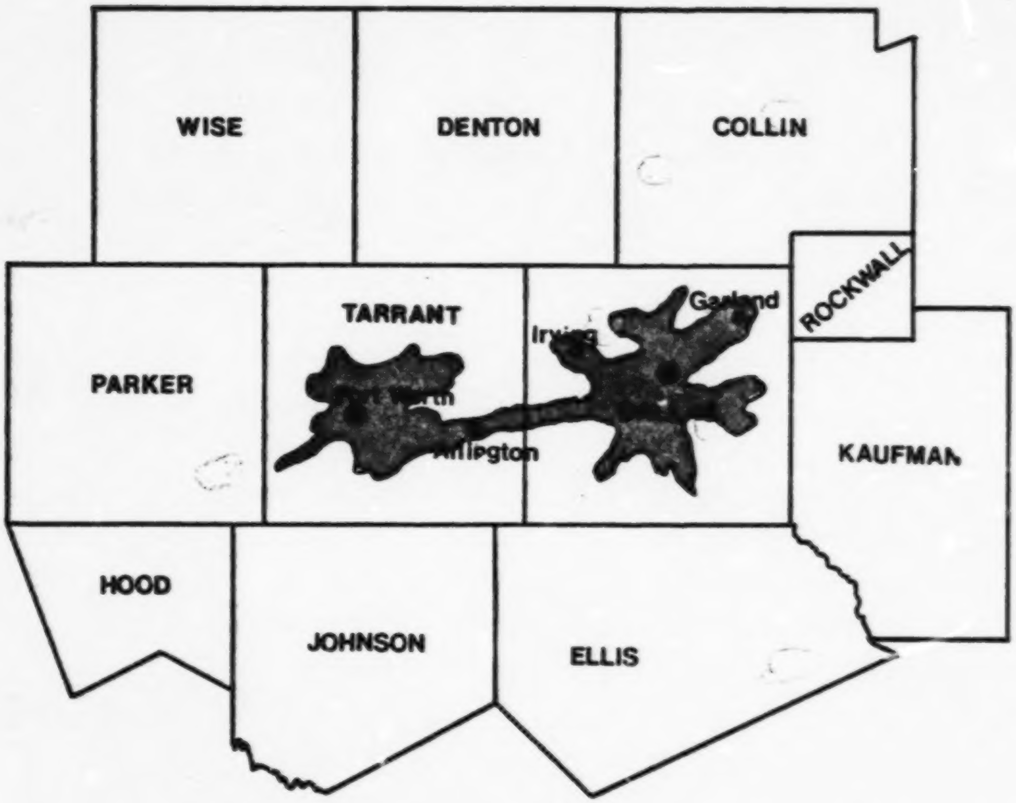
WISE
DENTON
COLLIN
TARRANT
Garland
ROCKWALL
Irving
PARKER
Arlington
KAUFMAN
HOOD
JOHNSON
ELLIS

EXHIBIT 5-2

Population of Counties in the Dallas Case Study Area

County	1970[1]	1980[2]	% Change 1970-1980
Collin	66,920	120,900	81
Dallas	1,327,695	1,523,000	15
Denton	75,633	110,300	46
Ellis	46,638	55,300	19
Hood	6,368	13,800	117
Johnson	45,769	62,600	37
Kaufman	32,392	37,200	15
Parker	33,888	38,500	14
Rockwall	7,046	11,600	65
Tarrant	715,587	810,600	13
Wise	19,687	23,400	19

[1] Source: U.S. Bureau of the Census.

[2] Source: 1980 Rand-McNally Commercial Atlas.

5.2 LOCAL REVIEW

The local development review process in Texas is very similar to that in Massachusetts. Texas' enabling legislation for subdivision regulation requires the owner of any parcel being subdivided to prepare a plat or plan of the subdivision showing new lot boundaries. Further, the county clerk is prohibited from recording any plat that has not received the approval of the City Planning Commission. The legislation also states that it is the duty of the City's governing body to approve the plat should it conform with "the goal of promoting health, safety, morals, or general welfare of the community, and the safe, orderly and healthful development of said community."[1]

Outside of these general guidelines, communities enjoy considerable autonomy in defining their review process. Most communities, however, have adopted similar procedures; development review in the Dallas area is exemplified by the process used in the City of Grand Prairie, which is outlined in Exhibit 5-3.

Development review in the Dallas area typically begins with informal discussions between the city staff and the developer prior to any formal submission of proposals. These discussions familiarize the city with the general characteristics of the project, clarify regulatory requirements, and identify potential design problems. Both municipal planners and developers interviewed for this project identified informal discussions as a key factor in keeping review periods short and in maintaining a cooperative atmosphere among participants.

The first review requirement faced by the developer is submission of a preliminary plat, which is reviewed by a committee consisting of the city traffic engineer and representatives of the planning board and police, fire, and public works departments. The plat review committee submits its recommendations to the Planning

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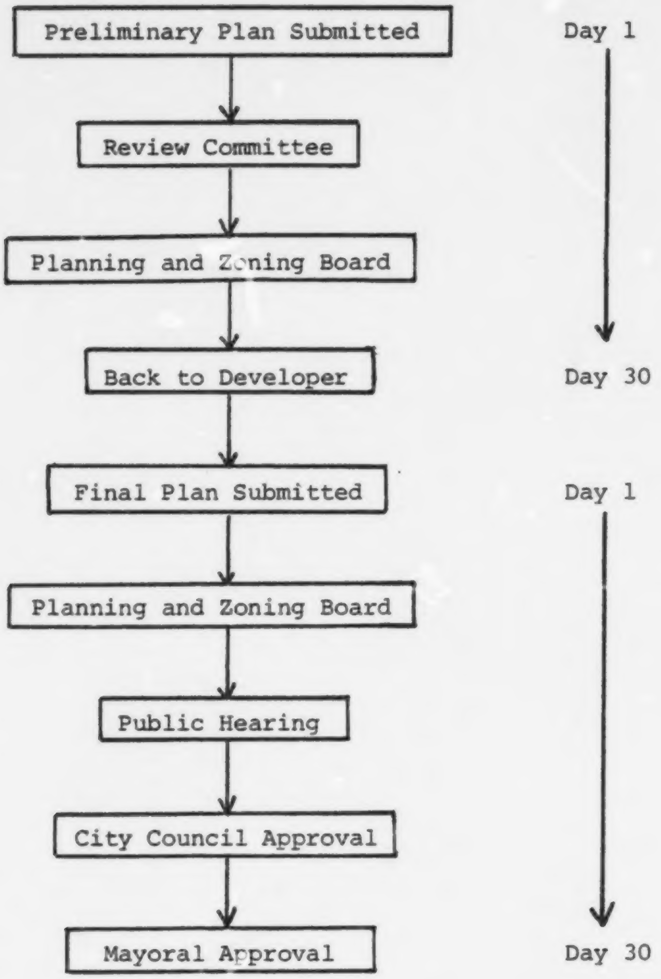
[1] Article 974a. Platting and Recording Subdivision or Additions.

EXHIBIT 5-3

REVIEW PROCESS FOR RESIDENTIAL PROJECTS IN GRAND PRAIRIE, TEXAS


Preliminary Plan Submitted
Day 1
Review Committee
Planning and Zoning Board
Back to Developer
Day 30
Final Plan Submitted
Day 1
Planning and Zoning Board
Public Hearing
City Council Approval
Mayoral Approval
Day 30

and Zoning Board, which reviews the plat and returns it with comments to the developer. This preliminary plat review takes 30 days.

The developer next submits a final plat including detailed plans for streets, sewers, water and drainage, and incorporating the comments from the preliminary plat review. The developer must also provide a floodplain map for those areas within the 100 year floodplain. The Planning and Zoning Board reviews the plat and passes it to the city council, which calls a public hearing and rules on the proposed development. The mayor must also approve the project before a building permit can be issued. Final plat approval requires 30 days; the entire review process in Grand Prairie lasts about 60 days. The process can take longer if the developer is required to make major design changes as a result of preliminary plat review.

Local review in Grand Prairie lacks two of the actors evident in Boston. First, there is no Board of Health review because all new development within the city is required to be sewered. Second, Massachusetts Conservation Committee does not have a Texas counterpart. No such body is required by Texas law and few, if any, communities have established one on their own initiative.

5.3 STATE AND REGIONAL AGENCIES

Development review may be even more of a "local-only" affair in Texas than in Boston. Although state and regional agencies administer federally-mandated planning and permitting programs for air and water quality, their direct involvement in project review is infrequent. The principal state and regional agencies affecting residential development are discussed below.

Texas state law authorizes the Department of Water Resources to set and revise water quality standards for all waters in the State. The Department also issues permits for discharges into or adjacent to the state's waters, including wastes from sewage treatment systems. Permits contain several project conditions:

- the duration of the permit;
- the location of the point of discharge;
- the maximum quantity of waste that may be discharged;
- the character and quality of waste that may be discharged; and
- monitoring and reporting requirements.

The Department may revoke or suspend a permit for noncompliance with its conditions and may sue any person discharging without a permit.

Along with point source control, the state permit program also provides the potential for control of nonpoint sources of pollution. The Department of Water Resources may also issue permits for any "discharge of waste"; under a broad definition, this could require a person who allows any form of pollution to enter the water in virtually any manner to obtain a discharge permit. In addition, the Attorney General has ruled that the Department may establish permit conditions other than the five criteria listed above. Therefore, the state discharge permit program could serve as a mechanism for regulating most, if not all, nonpoint sources of pollution; permits could incorporate "best management practices" developed in the areawide planning process.

In addition, state law requires cities with populations over 5,000 to establish water pollution control programs. Any city is allowed to establish such a program if desired. These programs must include discharge inventory, monitoring and sampling as well as control of urban runoff and non-point sources.

In reality, these authorities for non-point control are not exercised. At the state level, attention is currently being focused on development of a data base to identify the extent and severity of non-point loadings. The regional authority responsible for Section 208 areawide water quality planning in the Dallas area is now developing control strategies to deal with non-point problems as they are identified.

The Department of Water Resources also is the permitting authority for dredging, filling, and levee construction within the 100 year floodplain. Permit applications undergo an engineering review to determine the effects of the proposed development on 100 year flood levels.[1] Communities are authorized to accept the responsibility for controlling floodplain development, by participating in the Federal Flood Insurance Program, they effectively do so. The state's involvement in permitting is thus generally limited to unincorporated areas and cities which do not participate in the Federal Flood Insurance Program.

Unlike Massachusetts, neither environmental impact reviews or coastal zone management regulations play any role in residential development in Dallas. Texas does not have state NEPA-like legislation and no state agency reviews developments for impacts beyond their specific legislative mandates.[2] Texas has established a Coastal Zone program. However, Dallas is 260 miles from the Gulf Coast and therefore has no contact with this program.

5.4 FEDERAL AGENCIES

As in Boston, federal involvement with residential development is rather indirect except for EIS preparation for HUD housing projects and Federal Housing Administration and Veterans Administration Mortgage Insurance Programs.

The Army Corps of Engineers is also occasionally involved in residential developments within floodplains. This involvement consists of detailed engineering review of flood hazard potential within specific developments; these reviews are very infrequent and are usually performed only at the community's request.

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[1] The Federal Flood Insurance Program's standard of a 1-foot increase is used to determine acceptability.

[2] For example, the Texas Air Control Board reviews new source permit applications strictly in relation to impacts on air quality.

5.5 CASE STUDIES

Five residential projects were selected for case studies in the Dallas area. The case study selection process was essentially reversed from that used in the Boston area, since preliminary research indicated that few cities have developed environmental regulations to the extent of the Boston suburbs. Lacking a geographic focus for selection of individual developments, the research team solicited names of developers and projects with histories of environmental problems and delays. Staff of EPA Region VI, the North Central Texas Council of Governments, and some of the fastest growing communities were interviewed. The five projects selected from these suggestions represent projects which dealt with significant environmental regulation, and for which cost informaton was available.

Case D1

Case D1 is the largest development examined in this project; it covers 700 acres and will contain a total of 2600 dwelling units upon completion. 2200 single family homes have already been constructed and an additional 400 single and multi-family units are planned. Sale prices range from $50,000 to $70,000; a standard set of two to four bedroom floor plans is used in most of the development. The site straddles an escarpment which is one of the few natural wildlife habitats and areas of significant topographic relief in the Dallas area.

The developer filed the preliminary plat in August 1974 and received approval in June 1975. Throughout the local review process the developer worked closely with the city planning staff. This project appears to have received a considerable amount of attention from the city's staff, both because of its size and its proximity to the escarpment.

As a result of local review, the developers adopted several design changes to protect the fragile escarpment. These changes included realignment of some streets to make them more congruent to the curves of the cliff line as well as a delineation of a nondevelopable zone around the escarpment. Also, as a result of guidelines restricting land clearance, the developers determined that their large-scale construction techniques were not economically feasible on the land nearest the escarpment. These sections were therefore sold to other developers for construction of luxury, custom-built homes.

In 1975 the developer also deeded 800 acres along the escarpment to a local conservation group.[1] This foundation conducts research and public education projects and has received contributions from the developer.

The developer was required to provide trunk line connections to the city water system and the regional sewer system as well as to construct storm drains in an access road. A package treatment plant was operated for one year prior to connecting to the regional wastewater system.

Because the developer sought mortgage insurance assistance from HUD and the project exceeded that agency's threshold, an Environmental Impact Statement was required. A draft was filed on June 3, 1975 and a final EIS on October 31, 1975. Construction was begun before final EIS approval, however, because the project was allowed its first increment on June 5 under HUD's Early Start Program.

EIS review was completed in four months and did not result in any changes in the project. Because an early start was approved, construction was not delayed by the review.

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[1] The original proposed development covered 1800 acres of which only 700 were devoted to this project.

The $35,000 expenditure for EIS preparation is the only quantifiable cost directly attributable to federal environmental regulation in this case. The developer incurred two costs as a result of local review: design costs of realigning streets to conform to topography, and reduction in profits due to selling the sites nearest the escarpment rather than developing them. The developer also incurred costs in constructing water and sewer systems and connections to the municipal systems, as well as in constructing and operating a package sewage plant.

Case D2

Case D2 is a 548 acre planned unit development containing 1400 units of housing and 32 acres of office and retail uses. The residential section of the project has been completed; it is predominantly composed of single family houses, but also contains some townhouse apartments. The developer offered a choice of six basic floor plans for the homes which ranged in size from two to four bedrooms and were priced between $50,000 and $70,000. Lot sizes range from 7,500 to 10,000 square feet.

The preliminary site plan was submitted on March 18, 1975 following rezoning of the parcel, and was approved two months later. A preliminary plat was submitted on June 2, 1976 but, because of the project's size, final approvals were sought for twelve project increments. These increments ranged in size from 108 to 153 units and were approved over a 30-month period between October 1976 and April 1979. Each increment was reviewed for approximately two weeks before approval. The local review process did not result in any changes to the project design on environmental grounds, although the city did require 20% of the homes built be larger than 1600 square feet in an attempt to ensure the presence of higher income residents. The developer also built connecting lines to the regional sewer and municipal water systems.

As in Case D1, the developer sought home mortgage insurance assistance from HUD and initiated construction under the Early Start Program. A draft EIS was filed on September 3, 1976 and the final on March 12, 1977. Unlike Case D1, the developer was slow in preparing an Early Start application and did not receive approval to construct the first increment until March 1977. EIS review did not result in any changes in project design. As in Case D1, the only quantifiable cost directly resulting from Federal Environmental regulations is the cost of EIS preparation, $35,000. The costs of constructing the internal sewer and water systems and the external connections were unavailable.

Case D3

Case D3 is the smallest development examined in the Dallas area, 202 single family homes on 78 acres. The site was developed by two companies: the first purchased the land, secured plat approval, developed the lots and streets, and submitted the FHA application; the second developer purchased the improved site and built the houses. One hundred fifteen 3-bedroom houses have been completed and sold for $54,000 to $64,000; all lots are 7,475 square feet.

In June 1977 the developer submitted applications for site plan and rezoning approval. The zoning change was approved in September 1977 and the final site plan in January 1980.

During local review of the site plan, the city required the developer to prepare a map of the 100 year floodplain as required by the Federal Flood Insurance Program. Review of the map by the Army Corps of Engineers revealed that the map had been drawn incorrectly and that one proposed lot lay within the floodway (the area subject to most frequent and severe flooding). Because federal flood insurance regulations prohibit developments which will raise the floodway by more than one foot, this lot could not be developed.

The developer applied for HUD's home mortgage insurance assistance. However, because the subdivision contained only 200 lots, no EIS was required.

The costs of complying with flood insurance regulations are the only project costs attributable to environmental regulation; these include the cost of the lot plus its improvements and carrying costs, estimated at $5,900, and the cost of floodplain map preparation, which was not available.

Case D4

Case D4 is a 43 acre subdivision on which 65 single family homes have been completed; an additional 425 homes are planned for adjacent parcels. Lot sizes vary from 11,000 to 35,000 square feet; sale prices range from $100,000 to $324,000 for four bedroom homes. The developer purchased the land in 1978 and improved the lots. Independent contractors build the houses.

The site plan for the project was submitted to the city on April 24, 1978 and was approved two weeks later on May 8.

Several of the lots in the project lay below the 100 year flood level as delineated in the city's flood insurance map. In order to raise the level of these through fill, the developer obtained a Section 404 permit from the Army Corps of Engineers; this was accomplished in the same two week period as the local review. The developer estimated the cost of the filling operation at $6,000; this is the only project cost attributable to federal environmental regulation.

Case D5

Case D5 is a 444 unit single family subdivision on a 133 acre site. One hundred ten houses have been completed. They range in price from $60,000 to $70,000 and lots average 7,300 square feet.

The application to rezone the site from agricultural to residential was submitted in July and approved in September 1976. The site plan was submitted on December 17, 1976 and approved on January 10, 1977. No significant design changes were required by the local review.

The developer applied for mortgage insurance assistance for the project shortly after receiving approval from the city. A request for Early Start approval was granted shortly after the draft EIS was submitted on May 1977. The final EIS was not approved until December 1978. However, because of the Early Start Program, the 18 month review process did not delay the project. No design changes were required as a result of EIS preparation or review. The EIS preparation costs of $30,000 are the only costs attributable to Federal environmental regulations in Case D5.

CHAPTER 6

CASE STUDY ANALYSIS

6.0 INTRODUCTION

The two preceding chapters detailed the residential development process in the Boston and Dallas metropolitan areas, and described the impact of environmental regulations on nine projects. Before the costs of complying with these regulations are analyzed, it may be useful to summarize the characteristics of these nine case studies.

The cases represent a variety of development sizes, types and financial commitments, as demonstrated by Exhibit 6-1. Only one project involved the construction of rental housing; the other eight projects developed housing for sale. Six of the nine projects involved the development of single family detached houses, although two (in the Boston area) were multi-family developments, and a third was a mix of attached and detached dwellings. In addition, plans for one of the Boston cases and one Dallas case called for the incorporation of other uses (office and retail commercial, as well as light industry) into the overall project site plan. However, the research for these cases was focused only upon the residential portions of these projects, to ensure consistency with cost estimates across the other cases.

EXHIBIT 6-1

SUMMARY OF CASE STUDIES

CASE		TYPE OF PROJECT	TOTAL PLANNED UNITS	UNITS COMPLETED	TOTAL PROJECT ACREAGE	GROSS BUILT DENSITY	TOTAL PROJECT VALUE	VALUE/ UNIT	FEDERAL SUBSIDY
Boston:	B1	Multifamily (rental)	266	266	26	10.2 du/acre	$11,771,584*	$44,254	Section 8
	B2	Single family	39	39	39	1.0/acre	2,715,812	49,636	None
	B3	Multifamily	600	172	60	10.0 du/acre	34,166,972	46,945	None
	B4	Single family	65	65	45	1.4 du/acre	4,390,909	67,552	None
Dallas:	D1	Single family**	2600	2200	700	3.1 du/acre	156,000,000	60,000	Mortgage Insurance
	D2	Single family/ Multifamily mix***	1400	1400	516	2.7 du/acre	84,000,000	60,000	Mortgage Insurance
	D3	Single family	202	202	78	2.6 du/acre	11,918,000	59,000	None
	D4	Single family	490	65	327+	1.5+du/acre	103,800,000	212,000	None
	D5	Single family	444	110	133	3.3 du/acre	28,860,000	65,000	Mortgage Insurance

*Calculated on the basis of total emplacement costs.

**An additional 400 units of multifamily housing are planned but have not yet been built. Cost estimates were available only for the single family portion of the project.

***Plans also call for the development of an additional 32 acres for office and retail uses. Estimates of costs include only the housing portion of this project.

+Total Project Acreage was calculated on the assumption that the overall density would equal that of the first completed segment.

Project sizes varied greatly among the nine cases--from 39 units (in Case B3) to 2200 units (in Case D1). In general, the Boston area cases involved fewer units than developments in the Dallas area. Overall parcel sizes were also typically smaller in the Boston cases than in Dallas; this probably reflects both the greater growth rate and availability of land suitable for housing developing in the Southwest over New England. Development densities in both case study areas vary widely, with the lowest found among the Boston cases, where Case B2 was developed at a density of one unit per acre. In the Dallas cases, lots for detached single family housing ranged from 13,200 to 16,700 square feet, whereas in the Boston area cases, lot sizes for single family developments were closer to one acre (approximately 40,000 square feet). Generally, the Dallas cases involved the development of more land, but with smaller lots for each unit than in Boston.

Two of the nine projects had a total sales value of less than $10 million. On a per-unit basis, most of the cases had values in the range of $45,000 to $70,000. The lowest project value on a per unit basis was the multi-family case from the Boston area with an overall value of about $44,000 per unit. Sales prices for the Dallas houses averaged higher than sales prices in Boston, primarily due to one development of luxury housing. This is in spite of the fact that minimum lot sizes for single family detached family housing tended to be larger in eastern Massachusetts than in the Dallas area. Requirements for large lots with their associated longer street frontages tend to raise the price of the housing package, regardless of the characteristics of the dwelling built upon the lot. Only one of the nine projects applied for and received a direct federal subsidy (Case B1 was financed through the U.S. Department of Housing and Urban Development's Section 8 program). The only other federal participation in financing these cases came through the Federal Housing Administration's mortgage insurance programs, which provided insurance to three of the five Dallas cases.

These similarities and variations in project characteristics can provide some insight into the reported variations in costs due to compliance with environmental regulations. The discussion of costs in this chapter is presented in terms of the typology outlined in Chapter 2: costs are discussed in terms of expenditures for administrative requirements associated with regulations (Section 6.1), carrying costs associated with project reviews (Section 6.2), and compliance with requirements for mitigation of environmental problems (Section 6.3). The impact of environmental regulations on the cost of input materials for these nine projects is discussed in Section 6.4. Section 6.5 summarizes the costs which can be directly attributable to federal environmental regulations, and discusses costs incurred by complying with environmental regulations which are parallel to federal requirements. In each section, the costs as reported by developers are described, and factors to which the costs may be sensitive are examined.

6.1 ADMINISTRATIVE COSTS

The administrative costs associated with environmental regulations include the preparation of special studies which identify problems and develop appropriate mitigation, as well as the payment of permit fees. These costs are typically incurred as part of the development of a project design. The original concept for the development and detailed plans or specifications provide the base of information upon which an assessment of impacts can be made. The development of a project design is usually an iterative process, with changes made in response to a variety of environmental, financial or engineering considerations. Because of this, the costs associated solely with administrative factors required to comply with environmental regulations are frequently difficult to separate from the cost of meeting non-environmental project constraints. Costs associated with legal work necessary to obtain project approvals (including appeal of local board decisions and litigation) are also included in this cost category. This category addresses only costs incurred by the use of outside professional services; developers' in-house time is not included.

The discussion of administrative costs is based upon interviews conducted with developers and project reviewers. In these interviews, administrative requirements were identified (both by the developer and local officials), and cost information was supplied by the developer. Section 6.1.1 describes the administrative costs incurred by the nine case studies to meet environmental regulations. Section 6.1.2 identifies the administrative costs which are directly attributable to federal environmental regulations, and Section 6.1.3 identifies costs attributable to non-federal but similar environmental regulations at the state and local levels of government.

6.1.1 Description of Administrative Costs

The administrative costs incurred by the nine case studies in meeting environmental requirements are presented in Exhibit 6-2. This exhibit shows a wide variation in this type of cost. In addition, this exhibit also shows that the administrative costs incurred by the projects in the Boston metropolitan area are generally much higher per unit than costs incurred by the Dallas area projects.

Among the Boston area projects, the highest total administrative costs were incurred by Case B1, a project that took approximately ten years and several lawsuits to obtain necessary permits and approvals. Most of this project's administrative costs can be attributed to fees for legal representation at permit hearings. The $135,000 reported by Case B1's developer for legal fees does not include legal work for the "anti-snob zoning" challenge, but does include legal representation before the local Conservation Commission and Planning Board, and the state wetlands and water pollution control agencies.

Two of the Boston cases incurred costs related to the preparation of Environmental Impact Reports, required by the Massachusetts Environmental Policy Act. The costs of preparing these reports were similar--$25,000 for Case B1 and $20,000 for Case B3. Respondents

EXHIBIT 6-2

ESTIMATED ADMINISTRATIVE COSTS

CASE			AMOUNT	COST/UNIT	NATURE OF EXPENDITURE	TOTAL PROJECT VALUE	% ATTRIBUTABLE TO ADMINISTRATIVE REGULATIONS
Boston:	B1		$ 25,000		o Preparation of Environmental Impact Report		
			135,000		o Legal Fees		
			10,000		o Design/Engineering Changes to Plan		
		Total	$170,000	$639		$11,771,584	1.4%
	B2		$ 7,000		o Hygdrologic Study		
			3,500		o Sewerage Feasibility Study		
		Total	75		o Sewer Permit Application Fee		
			$ 10,575	$271		2,715,812	0.4%
	B3		$ 50,000		o Sewerage & Traffic Study		
			20,000		o Preparation of Environmental Impact Report		
		Total	$ 70,000	$407		34,166,972	0.2%
	B4	(none reported)				4,390,909	--
Dallas:	D1		$ 35,000		o Preparation of Environmental Impact Statement		
		Total	$ 35,000	$13		13,212,882	0.3%
	D2		$ 35,000		o Preparation of Environmental Impact Statement		
		Total	$ 35,000	$25		85,154,639	0.04%
	D3	(not available)			o Preparation of Floodplain Map	7,031,348	(N/A)
	D4	(none reported)				13,780,000	--
	D5		$ 30,000		o Preparation of Environmental Impact Statement		
		Total	$ 30,000	$68		8,771,481	0.3%

in both cases indicated that these costs were minimized by the incorporation of studies of special environmental issues that had been prepared for local government review. In Case B1, the Environmental Impact Report covered the full range of possible areas of concern. The report for Case B3, which was prepared several years later, focused on two issues judged to be the most important to the project's context. This scoping used by the latter case does not appear to have resulted in any significant cost reductions, however.

Requirements for the preparation of studies of a project's impact upon local infrastructure also resulted in administrative costs for several Boston cases. The size of the project had a direct impact upon the level of these costs; a 600-unit project (Case B3) required a $50,000 study of sewerage and traffic impacts, while a study of sewerage requirements for a 39-unit project cost only $3,500.

In only one of the Boston cases was a cost estimate available for the preparation of a hydrologic study of the project site, pursuant to complying with requirements for the management of storm runoff. In Case B2, this study was prepared for $7,000. Case B1 also involved some design changes for better storm water management. These changes were part of the estimated $10,000 reported for all project design alterations made to comply with environmental regulations.

Among the Dallas area cases, administrative cost estimates were available only for the preparation of federally-required Environmental Impact Statements. In the three cases for which these reports were required, the costs were reported to be similar, ranging from $30,000 to $35,000. Like the Boston cases for which Environmental Impact Reports were required, the project's size does not appear to have appreciably affected the cost of preparing this report. It should be noted, however, that only large projects are required to prepare a formal assessment of environmental impacts (under both federal and Massachusetts law). Therefore, these costs are only associated with projects larger than a certain threshold size. The costs of preparing these reports were found to be of the same magnitude in Dallas as in Boston.

The only other administrative cost reported for any of the Dallas area cases was the preparation of a floodplain map. Unfortunately, the developer was unable to provide an estimate for the cost of this study. Since floodplain maps are prepared by communities in Massachusetts rather than by developers, it is not possible to compare these costs between the two metropolitan areas.

At the same time, there does not appear to be a Dallas corollary to the wetland reviews conducted by Massachusetts communities. Generally, wetlands are not an issue of concern in watershort areas such as central Texas. However, Massachusetts has had a longstanding concern about this issue, and has developed innovative legislation for protecting wetlands.

Another difference between the two areas lies in their approaches to stormwater management. In Texas, this issue is characteristically handled through standard subdivision requirements which aim to remove stormwater from the development. Storm sewers are a typical solution. In eastern Massachusetts, where storm runoff is considered a cause of stream pollution, several communities required that developers minimize the runoff from the site itself. Typical solutions involve the construction of holding ponds which release stormwater slowly over a period of time, or the minimization of the paved area in a development. In both the wetlands and stormwater management issues, local and state regulations in Massachusetts can require more effort on the part of the developer than is required typically in Texas communities.

On a per-unit basis, these administrative costs vary between the Boston and Dallas case study areas, as shown in Exhibit 6-2. In general, they are significantly higher for the Boston cases, a situation that reflects the more intensive review requirements found in eastern Massachusetts communities. The highest costs per unit in this category occur with Case B1, which involved litigation to obtain necessary permits. On a per unit basis, the administrative costs in this case are more than twice the costs associated with the next highest case. Exhibit 6-2 also shows that these costs are fairly trivial for the Dallas cases: in only one of the three cases for which information was available did the costs exceed $50/unit.

Exhibit 6-2 indicates that the overall effect of these administrative costs relative to the project's total value is small. In all but one of the nine cases, administrative costs represented less than 0.01% of the project's total value (based upon sales prices). In the one case in which administrative costs represented more than one percent of the project's total value (Case B1), these costs included a substantial investment in legal fees that were necessary to obtain permits and approvals. This indicates that there may be a relationship between the degree of opposition to a project and its overall cost. However, because of the requirements of the federal subsidy program used to finance the project, the developer could not pass these added costs through to the tenants of this project.

6.1.2 Administrative Costs Directly Attributable to Federal Environmental Requirements

Three of the types of administrative costs associated with the nine developments can be directly attributed to environmental requirements promulgated by the federal government. These are:

- preparation of Environmental Impact Statements,
- preparation of a map delineating the project's relationship to the 100-year floodplain, and
- sewerage studies required under moratoria prohibiting new connections to wastewater management systems.

Environmental Impact Statements were required for three of the nine developments studied. As noted above, the three studies required similar expenditures (ranging from $30,000 to $35,000). It should be noted that this is a cost that is usually incurred only by large residential projects: The Department of Housing and Urban Development routinely requires an EIS only for projects involving more than 500 dwelling units in rural areas, and more than 2,500 units in urban counties. While smaller projects may be required to file an EIS if they are to be built in an environmentally sensitive area, extensive statements of impact are rarely required by HUD unless the public participation process identifies particular environmental issues. The costs associated with preparing an EIS are incurred at the start of the development process, entailing some risk if adverse impacts are found. It could be argued that the EIS was a known cost of selecting FHA financing, and that the developer still preferred that financing method to borrowing at market rates --in other words, that FHA financing with a required EIS still represented a net government subsidy to the project, compared to private financing.

The preparation of a floodplain map is a cost that can be directly attributed to a community's participation in the National Flood Insurance Program, as administered by the Federal Emergency Management Agency. The administrative costs associated with this program vary from one municipality to another, as communities select different approaches to implementing its requirements. Only one of the nine cases incurred administrative costs directly from this program. However, an estimate of the cost of preparing the necessary map was not available.

Three of the nine projects incurred administrative costs due to sewer connection moratoria. While these moratoria were not imposed directly by a federal agency, they can be attributed to compliance requirements of the Federal Clean Water Act. In all three of the cases affected by moratoria, the community's wastewater system was overloaded as flows exceeded the design capacity of a pump station in one case and interceptors in the other two cases. These overloads resulted in leakage of raw sewage into streams, which violated federal water quality standards, and moratoria were imposed to allow time for reduction of flows or planning for system expansions.

Therefore the administrative costs associated with the moratoria can be considered to be attributable to discharge permit requirements of the Federal Clean Water Act. In two cases, these costs were not large: $3,500 for a feasibility study of local sewerage options in the case of B2, and part of a combined $50,000 study of sewerage and traffic issues in Case B3. Case B1 was also affected by a moratorium on sewer connections. While no changes to the project design resulted from this moratorium (since the developer waited it out), administrative costs in this case are part of the legal fees incurred in defending the project before town and state boards and agencies.

When seen as a proportion of the total value of development, the administrative costs directly attributable to federal environmental requirements are small. The cost of preparing the three Environmental Impact Statements was less than 0.004% of the total value of these developments. In Case D2, the most expensive of all nine developments, the cost of preparing an EIS amounted to less than 0.1% of the project's total value. The administrative costs attributable to the Federal Clean Water Act represent an even smaller proportion of the development's value than do the EIS preparation costs, and administrative costs associated with the National Flood Insurance Program are unknown but thought to be small. In short, these costs do not form a significant proportion of the total value of the developments studied.

6.1.3 Adminstrative Costs Attributable to Parallel Environmental Requirements

Two types of administrative costs can be attributed to environmental requirements that are not federally promulgated, but that are similar to the requirements of federal programs. These are parallel costs. One type of parallel cost is directly modeled after a federal program: an example is Massachusetts' requirement for an Environmental Impact Report which may be required for a project not subject to EIS requirements. In this instance, the costs associated with preparing an Environmental Impact Report are analogous to those incurred elsewhere in preparing a federally-required Impact Statement.[1] There are other types of parallel administrative costs found in state or local requirements that are similar to those of federal environmental programs which have not yet been implemented in the case study area(s). An example of this type of parallel cost is the preparation of a plan for managing storm water drainage; similar requirements can be expected to result from an implemented areawide water quality management plan (funded under Section 208 of the Federal Clean Water Act). These plans have not yet been implemented by communities in eastern Massachusetts, although several towns have adopted local regulations which meet the 208 plan requirements for "best management practices" for nonpoint sources.

Generally, the costs associated with the preparation of state--required Environmental Impact Reports are similar to those incurred in preparing EISs. In the two Boston area cases for which these reports were prepared, the costs were approximately $10,000 less than the costs found with EISs in the Dallas cases. Boston area developers indicated that they were able to minimize the costs of preparing the Environmental Impact Reports by incorporating studies that were already being done for local reviews, such as studies of sewerage and traffic issues. There were no indications from the Dallas developers that this type of "piggybacking" was possible.

Two of the Boston cases also incurred the second type of parallel cost, through requirements for the preparation of plans for managing stormwater drainage. In Case B1, this cost is part of the $10,000 cited for design and engineering changes to the project's original design; this estimate also includes the cost of designing some sewerage changes. In Case B2, $7,000 was spent for a hydrologic study that was required to design an appropriate stormwater storage area. In neither case do these costs represent a significant proportion of the project's total value.

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[1] In fact, the federal EIS requirement has at times been waived because of the Massachusetts process has successfully resolved im-act issues. Here, state-mandated environmental costs have directly replaced federal ones.

6.2 CARRYING COSTS

Project delays due to compliance with environmental and other regulatory requirements can be difficult to quantify, since they depend to a large extent on expectations held by developers and project reviewers. What one side perceives to be a delay may be considered by another to be a realistic assessment of the time required to conduct a detailed review of a complicated project.

Cases from the two study areas indicate that there is a wide variation in the length of time required to complete project reviews, as shown in Exhibit 6-3. In the Dallas area, these reviews are conducted primarily by the local government, and environmental issues are not generally a focus of investigation. Exhibit 6-3 shows that the average total time in which the five Dallas cases were reviewed was eleven months. As a matter of fact, these five cases were selected because of their interactions with environmental requirements; typical review periods for all Dallas developments are probably substantially shorter than those experienced by these projects.

Average review times were longer for all levels of government in the Boston area cases. The average review time for these four cases was 20 months, or almost twice the time required to obtain necessary approvals in Dallas. In part, this longer time period can be attributed to the need to ensure that projects comply with state and local environmental regulations (such as wetlands protection) that are not found in the Dallas case communities. The lack of major direct federal involvement in the Boston case reviews indicates that federal environmental requirements tend to be indirectly implemented in eastern Massachusetts through parallel state and

EXHIBIT 6-3

LENGTH OF ENVIRONMENTAL REVIEW PROCESS

			LENGTH OF REVIEW PROCESS (MONTHS)					
CASE	NUMBER OF COMPLETED UNITS	NUMBER OF ACRES	LOCAL REVIEWS	STATE REVIEWS	FEDERAL REVIEWS	TOTAL REVIEW TIME*	OTHER ENVIRONMENTAL FACTORS	TOTAL LENGTH OF PROJECT PLANNING PERIOD**
B1	266	26	19	20	1	40	42***	75
B2	39	39	4	4	0	8	0	8
B3	172	60	15	8	0	23	17[+]	41
B4	65	45	10	0	0	10	0	10
Boston Average			12	8	-	20	15	33.5
D1	2200	700	10	0	6	16	0	16
D2	1400	516	8[++]	0	8	8	0	49
D3	202	78	7	0	3	10	0	10
D4	65	43	0.5	0	0.5	0.5	0	0.5
D5	444	133	4	0	18	19	0	29
Dallas Average			6	-	7	11	-	21

*Total Review Time is calculated by summing local, state and federal reviews. This total represents a project's "travel time" through the review system. Concurrent reviews are not counted in this total; nor is time taken by the developer to redesign a plan or prepare necessary studies (e.g., an Environmental Impact Statement).

**Total Length of the Project Planning Period represents time elapsed from submittal of the first (or preliminary) site plan to the start of construction.

***Moratorium on sewer extensions, challenges to building permit denial.

[+] Moratorium on sewer extensions.

[++] Includes review of 12 project increments averaging two weeks each, over a 30-month period.

local statutes. In Dallas, these reviews are conducted directly by the federal agency with regulatory responsibility. Another factor in the Boston cases' longer review times is the participation of state agencies as boards of appeal of local decisions, a situation which is not found in the Dallas area. In two of the four Boston cases, the length of time required for state approvals was equal to or greater than the time required for local reviews.

The size of the Boston projects appears to have some effect upon the length of the review process. In general, one would expect that larger projects (in terms of numbers of units, acreage or density) would be more complicated, and thus would take longer to review. The two largest Boston cases (each with more than 200 units) both encountered delays due to factors outside the normal review process; in both cases, these factors extended the review process significantly. Both of these developments were delayed by sewer moratoria. In addition, one developer spent more than two years challenging the town's decision to deny a building permit on the basis that the project would not be beneficial to the community. This local opposition was not found in any of the Dallas cases.

The relationship between project size and the length of the review period was not as clear cut in the Dallas area cases. The longest review period was found with Case D5, which is neither the largest nor the most densely developed project.

In measuring delays, the overall length of the project planning period must also be taken into account: some delays result from shifts in market conditions, or difficulties encountered by the developer in preparing for reviews. Exhibit 6-3 shows that the Boston and Dallas cases differ in the importance of the review process to the overall length of the planning period. In the Boston cases, the amount of time required for reviews constituted more than 67% of the planning period. In Dallas, however, the reviews occupied about half of the time required to plan the projects, on average. This indicates that delays in the Dallas cases were more likely to be caused by factors not related to the regulatory process, such as changes in market conditions, while delays in the Boston cases could more frequently be attributed to review requirements.

This section describes the costs associated with project delays. In Section 6.2.1, the costs associated with delays as reported by developers to be due to environmental requirements are identified. The costs which can be attributed to federal environmental requirements are discussed in Section 6.2.2, and costs associated with parallel requirements are presented in Section 6.2.3. In Section 6.2.4, the sensitivity of these reported costs to assumptions about inflation and about a nominal planning period is examined.

6.2.1 Description of Costs Associated with Length of Planning Period

Two types of costs are associated with the length of the planning and review period. The first type is directly measurable, and includes expenditures for property taxes, insurance and interest paid for land which cannot be developed while necessary approvals are obtained. Exhibit 6-4 shows that significant direct carrying costs were only reported in two of the nine case studies. These costs were not always proportional to the size of the project (and the price and assessment of the land). This exhibit shows that the direct carrying costs associated with Case B2 are almost 40% higher than those associated with Case B3, which involved nearly three times as many completed dwelling units. Case B3 was slowed by a moratorium on sewer connections, and took a total of 41 months to obtain the necessary permits. Case B2 obtained its necessary permits in eight months, with few problems. This difference stems from the higher assessed value of the land in Case B2, which indicates that the developer paid higher property taxes during the review period.

EXHIBIT 6-4

ESTIMATED CARRYING COSTS ASSOCIATED WITH PROJECT PLANNING PERIOD

CASE	DIRECT CARRYING COSTS	NATURE OF EXPENDITURE	NUMBER OF COMPLETED UNITS	DIRECT CARRYING COSTS/ UNIT	TOTAL LENGTH OF PROJECT PLANNING PERIOD (MONTHS)	INFLATION COSTS*	TOTAL CARRYING COSTS ASSOCIATED W/LENGTH OF PROJECT PLANNING PERIOD	TOTAL COSTS/ UNIT
Boston: B1	(none reported)	(land purchase was not closed until building permit was issued)	266	--	75	$2,976,000	$2,976,000	$11,200
B2	$50,000	o Taxes and insurance on land	39	$1,300	8	175,000	226,000	5,800
B3	$87,300	o Taxes, insurance, & interest on land loan	172	510	41	2,342,000	2,429,000	14,100
B4	(none reported)		65	--	10	1,004,000	1,004,000	15,400
Dallas: D1	(none reported)		2200	--	16	3,981,000	3,981,000	1,800
D2	(none reported)		1400	--	49	11,039,000	11,039,000	7,900
D3	(none reported)		202	--	10	394,000	394,000	2,000
D4	(none reported)		65	--	0.5	126,000	126,000	1,900
D5	(none reported)		110	--	29	388,000	388,000	3,500

*See Appendix D for derivation of inflation costs. Costs presented in this chapter have been rounded.

The lack of carrying costs reported for the other seven cases indicates either that these costs were so low as to be considered insignificant, or that estimates were not available. In Case B1, the developer did not actually purchase the land until all of the necessary approvals had been obtained, thereby avoiding carrying costs. However, the developers interviewed in the Dallas area did not make available information on direct carrying costs. This implies that Exhibit 6-4 underestimates these costs, since at least some of these cases probably had to pay property taxes, at a minimum.

The second type of cost in this category is that incurred through inflation during the project planning period. The inflation costs incurred in the nine case studies are also presented in Exhibit 6-4. These have been based upon estimates of the value of materials and labor for each case; the building cost index published monthly by Engineering News Record was used to estimate the proportion of the total construction costs which can be attributable to inflation. The process used to derive these estimates is presented in more detail in Appendix D.[1]

One could expect that the inflation costs incurred by these projects would be roughly proportional to the length of the project's planning period: longer planning periods and larger projects should be associated with higher inflation costs. In addition, project size should also be a factor.

While delays encountered in the review process certainly affect costs incurred due to inflation, there does not appear to be a consistent relationship between length of the delay or level of review and the level of inflation costs, as shown in Exhibit 6-4. The highest inflation costs on a per unit basis were incurred by Cases

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[1] It could be argued that inflation as such is not a cost, since both wages and prices tend to rise over the planning period. This argument states that the cost of concern is relative to inflation, or the relative change in construction cost compared to the overall economy. Section 6.2.4 describes this alternative analysis.

B3 and B4, which were neither the largest of the nine cases nor the most expensive. Also, the case which incurred the least cost per unit due to inflation did not experience the shortest review process (Case D1). The two projects which encountered delays due to sewer moratoria (Cases B1 and B3) incurred generally higher inflation costs, but not the highest costs in this category. The length of state and federal review processes also does not appear to have had a clearcut impact on either the total length of the planning period or (consequently) the inflation costs incurred by these projects.

Exhibit 6-4 appears to indicate that inflation costs are generally by far the larger of the two components in this category. However, this is an area where the lack of data may skew case study results. The inability to gather a complete set of data concerning interest paid on land loans and other carrying charges may indicate that these costs are truly insignificant in the developer's view in comparison to the indirect costs of inflation. This inability to gather data to substantiate this position may also mask the real relationship between these costs. In sum, the case studies did not provide conclusive information in this area.

6.2.2 Role of Federal Environmental Requirements in Costs Associated with the Length of the Planning Period

Some of the costs presented in Exhibit 6-4 can be attributed to federal environmental requirements, whether or not the reviews were conducted by a federal agency. The portion of inflation costs that can be attributed to federal environmental requirements was estimated by prorating total inflation costs on a monthly basis over the length of the planning period, and estimating the costs incurred in planning for and reviewing material for the federal requirements. Exhibit 6-5 summarizes this analysis, and presents estimates of inflation costs which can be attributed to federal environmental requirements in these nine developments.

EXHIBIT 6-5

REPORTED INFLATION COSTS ATTRIBUTABLE TO FEDERAL ENVIRONMENTAL REQUIREMENTS

CASE		TOTAL ESTIMATED INFLATION COST	TOTAL LENGTH OF PROJECT PLANNING PERIOD (MONTHS)	CASES SUBJECT TO FEDERAL ENVIRONMENTAL REQUIREMENTS	INFLATION COSTS/MONTH OVER PLANNING PERIOD	LENGTH OF PLANNING PERIOD FOR FEDERAL REQUIREMENT	INFLATION COSTS OVER "FEDERAL" PLANNING PERIOD	FEDERAL % TOTAL INFLATION COSTS	COST/ COMPLETED UNIT
Boston:	B1	$2,976,000	75	X	$ 39,700	9 months*	$ 357,000	12%	$ 1,300
	B2	175,000	8						
	B3	2,342,000	41	X	57,100	17 months*	971,200	41%	5,600
	B4	1,004,000	10						
Dallas:	D1	3,981,000	16	X	248,800	6 months**	1,493,000	38%	700
	D2	11,039,000	49	X	225,300	13 months**	2,928,600	27%	2,100
	D3	394,000	10	X	39,400	1 month***	39,400	10%	600
	D4	126,000	0.5	X	(review concurrent with local approvals)				
	D5	388,000	20	X	19,400	6 months**	116,400	30%	1,100

*Moratorium on sewer connections.

**Preparation and review of EIS.

***Preparation and review of floodplain study.

In the Boston cases B1 and B3, reviews required directly by federal environmental requirements stemmed from moratoria on sewer connections resulting from water quality standards. These moratoria lasted for periods of nine months for Case B1, and for 17 months for Case B3. Exhibit 6-5 indicates that the relative importance of inflation due to federal requirements depends upon the role of these issues in the overall review process. In Case B1, which was beset by many non-federal problems in addition to the sewer moratorium, inflation due specifically to the moratorium was estimated at $357,000 or 12% of total inflation costs incurred by the project. In Case B3, where the length of the entire project planning period was more dependent upon the sewer connection issue, inflation during the moratorium accounted for 41% of the project's total inflation cost, or $971,200.

Three of the five Dallas area projects were required to file Environmental Impact Statements. For the purposes of estimating inflation costs associated with the EIS requirement, the length of time taken by the developer to prepare the EIS must be considered along with the length of the agency review. In each of these three cases, approximately six months was spent in developing the EIS, in addition to agency review time. Two of the three Dallas EIS cases participated in HUD's Early Start program, in which construction is allowed to start on a project segment under certain conditions after the Draft EIS is filed. In both of these Early Start Projects, permission to start construction was granted almost immediately upon receipt of the draft EIS, so that the agency review times have not been considered in estimating inflation costs due to this requirement. Exhibit 6-5 shows that the proportion of inflation costs that can be attributed to the EIS process ranges from 38% in Case D1 to 30% in Case D5.

Two of the Dallas area cases, D3 and D4, were required to comply with provisions of the National Flood Insurance Program. In one of these cases (D4), this preparation and review was conducted simultaneously over a two week period with local reviews, and did not incur any additional inflation costs. In Case D3, however, the developer spent approximately one month preparing and reviewing a floodplain map. The inflation costs over this period amounted to almost 10% of the total costs in this category.

Exhibit 6-5 also shows that on a per unit basis, there is a wide variation in the impact of inflation costs upon this cost category. Four of the projects encountered planning periods for federal requirements of less than one year (Cases B1, D1, D3 and D5). Two of these projects (D1 and D3) experienced inflation costs that were less than $1,000/unit. However, it is not possible to conclude that shorter "federal" review times necessarily produce smaller inflation costs; in both Case D1, with inflation costing $700/unit, and D5, with inflaton costing more than $1,100/unit, the length of the federal review time was six months.

The paucity of data concerning direct carrying costs over the review period effectively prevents an overall estimation of the proportion of costs that can be attributed to federal environmental requirements. Only one of the nine cases was both subject to a federal requirement and able to supply data on direct carrying costs. In this case (B3), the direct carrying costs over the 41-month planning period amounted to less than 4% of the total costs in this category. In this one case, the direct costs attributable to the 17-month sewer moratorium account for approximately $36,000, or 41% of the project's total direct carrying costs. This amount represents less than 2% of all costs for this project in this category. However, this figure cannot be considered representative of costs in this category due to the lack of information for seven of the nine cases.

6.2.3 Carrying Costs Attributable to Parallel Requirements

These costs, which include time for planning and review of non-federal but parallel environmental requirements, may be estimated with the same methodology as was used for the federal costs. Costs for reviews of parallel regulations were found to be incurred only in the Boston area cases. These included the preparation and review of a state-required Environmental Impact Report (for cases B1 and B3), and the development of plans for managing stormwater runoff in all of the Boston area cases. As with costs incurred because of federal requirements, the lack of data for direct carrying costs prohibits the development of estimates for the impact of parallel regulations on this type of cost. However, impacts on inflation costs can be evaluated and compared with federal requirements.

Exhibit 6-6 shows that the inflation costs associated with preparation of a state-mandated Environmental Impact Report for case B1 are comparable to the cost of a federally-mandated EIS. This state requirement accounts for approximately 16% of the total inflation cost incurred by this project, and added some $1,800 to the cost of each unit. However, it should be noted that this requirement alone did not represent a delay for this development: while the Environmental Impact Report was being prepared, the developer was in the state's Land Court, attempting to obtain a building permit. Case B3 did not incur any inflation costs in preparing its Environmental Impact Report, because the requirement was not made until construction had started. In fact, construction on B3 did not stop while the report was being prepared, so that no time was spent solely on this requirement.

The estimation of inflation costs due to planning for the management of runoff (as a nonpoint source of water pollution) is more difficult to estimate, due to a lack of data concerning the time required to develop mitigation measures specifically for this

EXHIBIT 6-6

INFLATION COSTS ATTRIBUTABLE TO NON-FEDERAL PARALLEL ENVIRONMENTAL REQUIREMENTS

CASE		TOTAL ESTIMATED INFLATION COST	TOTAL LENGTH OF PROJECT PLANNING PERIOD (MONTHS)	INFLATION COST/ MONTH OVER PLANNING PERIOD	LENGTH OF PLANNING PERIOD FOR EIR	INFLATION COSTS OVER EIR PLANNING PERIOD	% TOTAL INFLATION COSTS	COST/ COMPLETED UNIT
Boston:	B1	$2,976,000	75	$39,700	12 months	$476,100	16%	$1,800
	B3	$2,342,000	41	57,100	--	--		

issue. In each of the Boston cases, developers were unable to separate time required for stormwater issues from other local environmental or legal requirements. Without information on the length of the planning period, it is not possible to estimate the inflation costs of complying with non-point source requirements.

6.2.4 Sensitivity Analysis

Carrying costs, as reported in the case studies, are almost entirely dependent on the length of the project planning period. Since this period varies from one case to another (and in fact was difficult to define with the interview resources available), the discussion of reported carrying costs has been presented in terms of the total length of the planning period, without consideration that a certain amount of review time is both necessary and normal for any project. This section examines the effect of an assumption of a nominal review period upon estimated inflation costs.

Lacking information about "normal" review periods, two assumptions were used. For the Dallas area cases, the "typical" review period described for the community of Grand Prairie, Texas in Exhibit 5-3 was used. Three months were subtracted from the beginning of the total project planning period to account for expected review time. Inflation costs were then estimated for the remaining portion of the planning period, using the date of construction start as the end point. In one case, which was actually reviewed in a two-week period, this nominal review assumption was not used, since a three month review time would place the start of construction past the actual date by ten weeks. For this case (D4), no comparison could be made.

For the Boston cases, an assumption of a six month "nominal" review period was used. This was based on a study of local land use regulations for the Town of Bridgewater which is in southeastern Massachusetts just outside the study area used for this project. While there is some evidence that in the suburban communities closer

EXHIBIT 6-7

SUMMARY OF REPORTED CARRYING COSTS

CASE	TOTAL REPORTED CARRYING COSTS/COMPLETED UNIT	FEDERAL CARRYING COSTS/COMPLETED UNIT	PARALLEL CARRYING COSTS/COMPLETED UNIT
Boston: B1	$11,200	$1,300	$1,800
B2	5,800	--	--
B3	14,100	5,600	--
B4	15,400	--	--
Dallas: D1	1,800	700	--
D2	7,900	2,100	--
D3	2,000	600	--
D4	1,900	--	--
D5	3,500	1,100	--
Case Average	7,100	1,300	200

to the center of Boston review times typically can be from nine months to a year in length, there is also some evidence that typical periods in outlying communities without sophisticated land use controls are substantially less than six months.[1]

Exhibit 6-8 presents the results of this analysis. In one of the nine cases, the assumption of a nominal planning process did not change the estimated inflation costs incurred by the project on a per unit basis. Of the remaining eight cases, the assumption of a nominal planning period led to lower estimated inflation costs. In these four cases, the impact of this assumption varied greatly: in three cases, estimated inflation costs were decreased by between 16% and 92%, and in one case, inflation costs were reduced by 6%. In the remaining four cases, estimated inflation costs actually increased. This variation is due to the fluctuations in both the building industry and in the economy as a whole during these planning periods. There does not appear to be a correlation between the length of the planning period and its reduction by a nominal amount in terms of inflation costs incurred.

It can be argued that the inflation costs estimated in this section reflect not only inflation in the building industry, but also inflation in the economy as a whole. To test this, the proportional change in the Building Cost Index that was used to calculate the inflation estimates was compared with the proportional change in the implicit price deflator for the Gross National Product.[2] This analysis is presented in Exhibit 6-9, which shows that in all cases the difference between the two indices was less than 5%. This indicates that the inflation costs estimated for these nine cases can largely be attributed to inflation in the economy as a whole, and not just to the building industry. In short, in real dollars, inflation affected these cases only slightly.

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[1] These views were made clear by virtually all of the Boston area developers who participated in the case studies.

[2] Published quarterly by the Bureau of Economic Analysis, U.S. Department of Commerce.

EXHIBIT 6-8

COMPARISON OF INFLATION COSTS WITH AND WITHOUT ASSUMPTION OF NOMINAL REVIEW TIME

CASE		ESTIMATED INFLATION COSTS OVER TOTAL PLANNING PERIOD		ESTIMATED INFLATION COSTS W/ASSUMPTION OF NOMINAL PLANNING PERIOD		% DIFFERENCE/ UNIT	TOTAL LENGTH OF PROJECT PLANNING PERIOD (MONTHS)
		AMOUNT	$/COMPLETED UNIT	AMOUNT	$/COMPLETED UNIT		
Boston:	B1	$2,976,000	$11,200	$3,048,000	$11,500	+ 3%	75
	B2	175,000	4,500	113,000	2,900	-36%	8
	B3	2,342,000	13,600	2,364,000	13,700	+ 1%	41
	B4	1,004,000	15,400	933,000	14,400	- 6%	10
Dallas:	D1	3,981,000	1,800	4,439,000	2,000	+12%	16
	D2	11,039,000	7,900	9,311,000	6,700	-16%	49
	D3	394,000	2,000	34,000	200	-92%	10
	D4	126,000	1,900	126,000	1,900	--	0.5
	D5	388,000	3,500	809,000	7,400	+110%	29

EXHIBIT 6-9

SENSITIVITY ANALYSIS

Case	Estimated Project Construction Cost	Inflation Costs Over Reported Planning Period		Building Cost Increases Relative to Overall Rate of Inflation	
		Amount	% of Estimated Project Construction Cost	Amount	% of Estimated Project Construction Cost
Boston: B1	$ 8,724,800	$3,047,900	35%	-$ 1,200	--
B2	2,516,000	113,200	4%	113,200	4%
B3	20,799,600	2,364,100	11%	361,900	2%
B4	3,202,900	933,400	29%	72,300	2%
Dallas: D1	85,893,700	4,439,100	5%	1,142,000	1%
D2	54,660,200	9,311,300	17%	-546,400	--
D3	4,953,100	34,400	1%	-119,400	--
D4	10,059,400	126,000	12%	126,000	1%
D5	4,588,900	808,900	18%	187,500	4%

In sum, the carrying costs reported by the case studies were found to be most sensitive to estimated inflation--for both carrying costs as a whole and for costs attributable to federal environmental requirements. Real carrying costs are probably greater than what was reported, since information about direct carrying costs was largely unavailable. In this situation, the estimated inflation costs assume a large proportion of the total expenditures in this category. However, the inflation costs also may be overstated, since in real dollars their impact was small.

6.3 COMPLIANCE COSTS

This section describes the incidence of compliance costs in the nine case study projects. Compliance costs are expenditures attributable to physical changes in the project or in its construction, which have been incurred in meeting environmental regulations or in mitigating environmental impacts. Examples of these costs include construction of a package sewage treatment plant, elevation of structures or lots above a 100-year floodplain, or minimization of ground cover disturbance during construction to control erosion.

Compliance costs are very likely to be the "big ticket" items among the costs attributable to environmetal regulations. As such, these costs might be expected to be fairly easily obtained, but this is not necessarily the case. For most developers, costs are not sufficiently compartmentalized that compliance costs can be easily separated. Labor and equipment costs for sewer construction, for example, may well be inseparable from the costs of developing the drainage system or streets. For the nine case studies investigated, in fact, many costs were unavailable. Sanitary sewer costs, for example, were available in only one case, although they are probably the largest potential compliance costs. The costs of drinking water development likewise were totally unavailable and storm drainage costs were reported in only a few cases. The following discussion is therefore limited to the availability of cost data.

Because of the limits of the data collected in interviews, three assumptions have been used in analyzing the costs of complying with environmental regulations. The basic approach assumes that compliance costs are well represented by the costs reported in the interviews, and analyzes these costs as reported. These are described in Sections 6.3.1 to 6.3.3. However, these costs as reported may not be representative of the realities of housing development--for instance the costs of installing storm sewers may be seen as normal design requirements rather than as mitigation of an environmental issue. Section 6.3.4 presents costs based upon two alternative assumptions:

- Inclusion of all environmental compliance costs, using approximations for unreported storm drainage and sanitary wastewater management; and
- Inclusion of only special environmental costs, under the assumptions that "standard practice" requires sewers and storm drainage.

6.3.1 Description of Compliance Costs

Estimates of compliance costs were available for five of the nine case studies and are summarized in Exhibit 6-10. All of the reported costs fall into three categories: sanitary sewers, storm drainage, and floodplain alterations. Individual costs range from $5,900 for loss of one floodplain lot to $505,000 for storm sewer installation. Environmental costs for the five projects range from 0.1% (B1) to 7.8% (B2) of total project value; these percentages represent per unit costs ranging from $53 to $5,400.

No clear patterns emerge to correlate the level of compliance costs with the principal project characteristics: number of units, acreage, density, or unit value. Not surprisingly, the projects with the most complete reporting of costs--B2, D3, and D4--exhibited the highest average costs. Of these three, D4 may be the most representative as it contains all three categories of compliance costs. D4's average compliance cost of $4,960 per unit translates to a relatively low 2.3% of total project value, because of the high sale prices of the project's homes.

EXHIBIT 6-10

ESTIMATED COMPLIANCE COSTS

CASE			AMOUNT	COST/ BUILT UNIT	NATURE OF EXPENDITURE	TOTAL PROJECT VALUE	% OF TOTAL PROJECT VALUE ATTRIBUTABLE TO ENVIRONMENTAL REGULATIONS
Boston:	B1		$ 14,000		o Sewer Connection		
		Total	$ 14,000	$ 53		$11,772,000	0.1%
	B2		$100,000		o Storm Sewer Construction		
			37,000		o Stream Alteration		
			75,000		o Road Elevation		
		Total	$212,000	$5,440		$ 2,716,000	7.8%
	B3	(none reported)		NA		$34,167,000	NA
	B4		$ 25,000		o Storm Runoff Storage Area		
		Total	$ 25,000	$ 385		$ 4,391,000	0.6%
Dallas:	D1	(none reported)		NA		$13,213,000	NA
	D2	(none reported)		NA		$85,155,000	NA
	D3		$505,000		o Storm Drainage Construction		
			5,900		o Removal of Lot in Floodplain From Sale		
		Total	$510,900	$2,530		$ 7,031,000	7.3%
	D4		$179,000		o Sanitary Sewer Construction		
			138,000		o Storm Drainage Construction		
			6,000		o Elevating Lots Above 100-year Floodline		
		Total	$323,000	$4,964		$13,780,000	2.3%
	D5	(none reported)		NA		$ 8,771,000	NA

D4 is in fact, the only project for which full sanitary sewer costs were reported. Total environmental costs are therefore probably understated for the other eight cases.

6.3.2 Costs Attributable to Federal Environmental Regulation

Two types of mitigation costs reported in the case studies are attributable to federal regulation: floodplain and sanitary sewer costs. Compliance costs associated with floodplain regulation were reported in D3, D4, and B2. In the latter two cases the costs resulted from filling land to raise it above the 100-year flood line; in B2 $75,000 was spent to elevate a road and in D4 several lots were filled at a cost of $6,000. In D3 a cost of $5,900 was incurred as a result of a miscalculation by the property owner on the location of the flood line, which led to the lot being withheld from sale. The reported cost for this one lot may slightly overstate the actual cost attributable to federal regulations, as it apparently contains the cost of providing services to the lot. Had the map been properly drawn, these service costs may have been avoided.

The cost impact of floodplain regulations varies considerably between the three cases. In D3 and D4, these costs amounted to $6,000, or less than $100 per built unit. The road elevation in B2 was considerably more expensive, totalling $75,000 ($1,923/unit). As these case studies indicate, the magnitude of floodplain compliance costs is highly site-specific; it is dependent both on the extent of the site below flood level and the difficulty involved in elevating or flood proofing the property.

The second major area of federal compliance costs is expenditure for sanitary sewers. These costs were reported in two cases: a $14,000 cost for connecting B1 to the municipal sewer system and $179,000 for constructing the sewer system in D4. These costs represent average unit costs of $53 and $2,753 respectively. The latter figure is probably more representative of typical subdivision compliance costs as it accounts for D4's entire sewage collection system rather than merely an external connector to the municipal system.

The task of attributing sewerage costs to federal regulation is extremely difficult. Although the Federal Clean Water Act calls for ambient water quality standards, secondary treatment equivalent, and point source permits, it is not obvious at the individual development level at what point the federal law becomes more influential than state or local codes. In the Dallas area, for example, several communities require all developments within the city to be sewered. It is doubtful that this requirement was influenced by the Federal Clean Water Act; it more likely resulted from the exercise of state or local health regulations in an area of generally poor soil conditions.

A realistic attribution of costs to federal, state and local environmental regulations would require a detailed breakdown of the costs for sewer system components. For example, if it could be determined that in case D4, conventional sewers were used only to comply with federal water quality standards and that on-lot septic systems would have been sufficient to meet local requirements, it would be necessary to identify costs associated with sewers that exceeded what it would have cost to install septic systems. This level of detail was not available in any of the case studies; only in D4 were even aggregate data available. Given the level of detail in the case study data, reliable attribution of federal costs was not possible.

6.3.3 Other Compliance Costs

The remaining compliance costs reported in the case studies are related to storm drainage: construction of storm sewers and runoff storage, and--in one case (B2) alteration of a stream to enhance downstream flow. The stream alteration and storage construction costs were the lowest of this group, accounting for $949 and $385 per unit respectively. Storm sewer construction was considerably more expensive, averaging $2,400 per built unit.

None of these storm drainage costs can as yet be directly attributed to federal regulations. Although Section 208 of the Federal Clean Water Act authorizes areawide water quality planning (including control of nonpoint sources such as storm runoff) neither the Boston nor Dallas 208 program has yet resulted in implementation of control strategies at the project level. The storm drainage costs incurred by these projects can thus only be attributed to local regulation. In the cases examined here, in fact, it is not clear that stream quality protection was the motivating consideration; erosion and flood control may have been paramount instead. In any event, these costs are attributable to the types of controls which can be expected to be implemented under the 208 program in the future.

6.3.4 Sensitivity Analysis

One difficulty with relying on reported compliance costs as described above is that some activities are not considered by all developers to be responses to specific environmental regulations, but are seen instead as normal costs of developing any housing project. Prime examples of this are costs for installation of storm or sanitary sewers and ancillary wastewater treatment facilities. In only four of the nine cases were stormwater management costs reported, and in only two cases were any costs associated with installation of sanitary sewers considered. Stormwater drainage is typically regulated by a community's Subdivision Ordinance, and so may not always be considered strictly an environmental requirement. Similarly, developers are presumed to provide for some type of sanitary wastewater disposal, whether via on-lot septic systems or sewers that are tied into a community-wide collection and treatment system. In other words, most developers assume that these services will be provided in a development; the question of cost incurred from an environmental requirement translates to the construction of a system or facility over and above what the developer would have provided in the absence of the requirement.

Other reported compliance costs can be considered to be a function of location, and represent expenses that would not have been required if the environmental regulations were not present, or if the developer had chosen another site. These costs include expenses reported for elevating a lot or road above a 100-year floodplain, or the alteration (or protection) of streams, wetlands, and other environmentally sensitive areas.

Exhibit 6-11 shows that levels of reported compliance costs are extremely sensitive to assumptions about the types of activities which are included. When reported costs for managing storm and sanitary wastewater are removed, the average compliance cost across the nine cases drops from $1,490 to $333. The remaining costs in this category are expenses required to mitigate environmental problems of a particular site. This exhibit shows these latter costs to be inconsequential; under this assumption, reported compliance costs fall to a very small proportion of total project value for these nine cases.

6.4 COST OF INPUT MATERIALS

As described in Chapter 3 above, many of the materials used in building a housing project are manufactured by processes subject to pollution control requirements. The requirements which most directly effect industries manufacturing housing-related products are those contained in the Clean Air and Water Acts; requirements in other federal legislation (e.g., the Resource Conservation and Recovery Act) remain to be fully implemented.

The costs of concern for housing input materials are those associated with compliance of the regulations described in Chapter 3. These include:

- o Effluent Guidelines and Criteria Pollutant Documents
- o National Ambient Air Quality Standards and Water Standards
- o Hazardous Pollutant Standards
- o New Source Performance Standards and Permit Requirements
- o State Implementation Plans

EXHIBIT 6-11

COMPLIANCE COSTS: SENSITIVITY ANALYSIS

	Adjusted Compliance Costs			
Case	Reported Compliance Costs/Unit	Reported Sanitary Wastewater Cost/Unit	Reported Stormwater Costs/Unit	Total Adjusted Compliance Costs/Unit
Boston: B1	$ 53	$ 53		
B2	5440		$2650	$2880
B3				
B4	385		385	2000*
Dallas: D1				
D2				
D3	2530		2500	30
D4	4960	2750	2120	90
D5				

*Costs/Unit reflect expenses of installing on-lot septic systems.

The costs of complying with these requirements (which are entirely federal in origin) add to the cost of producing input materials for housing. These costs are generally passed on to the purchasers of the products--builders--and ultimately to the housing consumer.

A comprehensive assessment of the impact of environmental regulations on housing costs should consider the magnitude of these indirect costs. A study conducted for EPA and the Council on Environmental Quality[1] has estimated these costs to be about 4.5% of the total cost of materials used in construction of a housing project in 1979, and about 4.6% in both 1978 and 1977. Exhibit 6-12 describes the impact of these federal pollution control requirements on the costs of input materials in the nine case studies. The methodology used to derive these indirect costs is presented in Appendix D.

This exhibit shows that for seven of the nine cases, the pollution control requirements for input materials added between $140 and $1,100 to the cost of each unit. For two of the nine cases, the cost/unit are much greater--$1,850 in the case of B2 and $2,900 in the case of D4. While these developments contain fewer than the average number of units (for all nine cases), the houses in each carried the highest selling price of the cases in their area; one could expect more costly materials to be used, with a higher proportion of materials costs attributable to pollution control requirements. Similarly, the houses in case B2 brought higher than the average selling price for the Boston area cases; the higher per unit input costs due to federal environmental requirements could be due to larger units with more costly materials. In all cases, these costs were less than 4% of the value of the completed units.

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[1] The Macroeconomic Impact of Federal Pollution Conrol Programs: 1978 Assessment. Prepared by Data Resources, Inc. for U.S. EPA and the Council on Environmental Quality. January 1979.

EXHIBIT 6-12

IMPACT OF POLLUTION CONTROL STANDARDS ON INPUT MATERIALS

Case		Materials Costs Due to Federal Environmental Requirements*	Total Completed Units	Cost/Completed Unit	Value of Completed Units	Cost/Value of Completed Units
Boston:	B1	$230,500	266	$ 870	$11,771,600	2%
	B2	71,900	39	1850	2,715,800	3%
	B3	168,800	172	980	34,167,000	--
	B4	60,000	65	920	4,390,900	--
Dallas:	D1	2,432,100	2200	1110	156,000,000	2%
	D2	1,547,700	1400	1110	84,000,000	2%
	D3	159,600	202	790	11,918,000	1%
	D4	188,500	65	2900	103,800,000	--
	D5	62,700	444	140	28,860,00	--

*See Appendix D for the derivation of these costs.

The existing literature has only examined the impact of federal pollution control requirements on housing input costs. The impact of non-federal environmental requirements has not generally been examined. Therefore, only the indirect costs of federal requirements are considered.

6.5 SUMMARY

The preceding sections presented the costs incurred by case study projects in each of four categories: administrative, carrying, compliance and input materials. In this section, these costs are summarized as they were reported by developers. In addition, this section summarizes costs as adjusted by the sensitivity analyses described for inflation and compliance costs, for the purpose of ensuring a level of consistency among all the reported costs. These scenarios are presented in Sections 6.5.1 and 6.5.2. In Section 6.5.3, the two sets of costs are compared, and the limitations of the case study approach in determining the impact of federal regulations on housing costs are discussed.

6.5.1 Summary of Reported Costs

Costs incurred by each of the cases to meet environmental requirements are summarized in Exhibit 6-13 as they were reported in interviews with developers. This exhibit shows that, across the nine cases, reported costs for meeting all environmental requirements were slightly less than $10,000 on a per unit basis. It also indicates that higher costs were incurred by the Boston cases than by the Dallas area projects.

Two of the four types of costs appear to have had the largest impact upon the level of total costs incurred to meet all environmental requirements. These are carrying costs and indirect costs associated with manufacturing input materials. Interestingly, both of these types were derived from estimates of constructon costs and the length of the project's planning period. Together, they account for more than 80% of the total environmental costs of the average project.

EXHIBIT 6-13

SUMMARY: REPORTED COSTS/UNIT

Case		Administrative		Carrying		Compliance		Input		Total	
		Cost/ Unit	Federal Cost/ Unit	Cost/ Unit	Federal Cost/ Unit	Cost/ Unit	Federal Cost/ Unit	Cost/ Unit	Federal Cost/ Unit	Cost/ Unit	Federal Cost/ Unit
Boston	B1	$640	$ 80*	$11,200	$1,300	$ 50		$ 870	$ 870	$12,760	$2,250
	B2	270	90*	5,800		5,440	$1,923	1,850	1,850	13,360	3,860
	B3	410	150*	14,100	5,600			980	980	15,490	6,730
	B4			15,400		390		920	920	16,710	920
Dallas:	D1	10	10	1,800	700			1,100	1,100	2,920	1,820
	D2	30	30	7,900	2,100			1,100	1,100	9,030	3,240
	D3			2,000	600	2,530	30	790	790	5,320	1,420
	D4			1,900		4,960	90	2,900	2,900	9,760	2,990
	D5	70	70	3,500	1,100			140	140	3,710	1,310
AVERAGE		160	50	7,060	1,270	1490	230	1,190	1,190	9,900	2,730

*Estimated from portion of costs in this category incurred to meet specific Federal requirements.

Case		Total Reported Cost/Unit			Project Value/Unit		
		Amount	Federal Cost	% Federal	Project Value/Unit	Federal Cost/ Unit Project Value	All Reported Costs/Unit Project Value
Boston:	B1	$12,760	$2,250	18%	$44,300	$2,250	5%
	B2	13,360	3,860	29%	64,600	3,860	6
	B3	15,490	6,730	43%	56,900	6,730	12%
	B4	16,710	920	6%	67,600	920	1%
Dallas:	D1	2,920	1,820	62%	60,000	1,820	3%
	D2	9,030	3,240	36%	60,000	3,240	5%
	D3	5,320	1,420	27%	59,000	1,420	2%
	D4	9,760	2,990	31%	212,000	2,990	1%
	D5	3,710	1,310	35%	65,000	1,310	2%
AVERAGE		9,900	2,730	28%	76,600	2,730	4%

Exhibit 6-13 shows that for the average case, the level of costs incurred to meet environmental requirements is primarily dependent upon carrying costs, which are in turn dependent upon the length of the planning period and the rate of inflation during this time. However, these estimates of carrying costs may be understated in one way and overstated in another. Data concerning direct carrying costs were available for only a few of the nine cases, and the costs reported for property taxes and land financing are considered to be underestimated. There are many possible methods of holding land during the project planning period, and some of the direct carrying costs can be shifted from the developer to the landowner where the developer acquires only an option to purchase the parcel rather than purchasing the land in fee simple (as in Case B1). In general, these costs are believed to be underestimated. At the same time, the estimates of inflation are probably overstated. These costs were estimated on the basis of the total length of the planning period, since little reliable information was available to document true delays in the planning process due to environmental regulation. This cost category accounts for most of the difference between the Boston and Dallas cases: planning periods in Boston tended to be longer than in Dallas (primarily due to the involvement of state agencies in the permitting process). This in turn led to higher estimated inflation costs, and higher carrying costs in general.

Where complete compliance costs were available, they appear to be at least as significant as the carrying costs. They also appear to be greater than the indirect costs associated with manufacturing input materials. In the compliance cost category are expensive items such as sanitary and storm sewer systems, whose costs dwarf those of floodplain controls--the only other type of compliance costs which were available.

Administrative costs were reported to have the least influence on costs of meeting envionmental requirements, as they account for only two percent of the average reported cost. These costs also may be underestimated, since they include only professional services purchased to supplement the developer's staff, such as legal, architectural or engineering skills. This category may also suffer from the same tendency to underreport that is suspected with compliance costs: both types may be considered to be normal project expenditures--e.g., most developers use some type of professional engineering service, and wastewater must be dealt with in any housing project design. Developers may not attribute these costs directly to environmental requirements, and thus will not report them in interviews.

Given all of these caveats, the overall reported costs were about 4% of the average unit value or selling price, across all nine cases. These costs tended to account for a higher proportion of unit value in the Boston area cases than in the Dallas projects, due to the lower value and higher per unit carrying costs of the Boston projects.

The reported costs attributable to complying with federal environmental requirements are also shown in Exhibit 6-13. On average these federal requirements accounted for some 28% of all environmental costs, and Exhibit 6-13 shows that the same two categories--carrying and input costs--contain most of these expenditures. As with the overall costs, the lack of data for compliance expenditures may skew these reported costs toward the categories in which costs were estimated consistently across all nine cases. For example, none of the developers interviewed could estimate the portion of sewerage costs which were required by federal water pollution controls, or the difference in costs between installing a collection and treatment system rather than individual septic systems which would have been allowed in the absence of federal regulations. Since these costs were not available (and may be considered normal project costs which are not associated with specific environmental requirements per se), the costs which were reported consistently tend to determine the level of costs incurred to meet federal environmental requirements.

The costs attributable to federal requirements appear to be a more significant proportion of all environmental costs in the Dallas cases than in Boston projects. This may be due to a higher degree of state involvement in housing development in the Boston area--there are more agencies to impose requirements which result in costs to the developer. The relative scarcity of prime building land in the Boston area may also be an indirect factor: local and state reviews have traditionally been concerned with the types of community-wide environmental impacts that are the subject of many federal regulations; these have to a large degree been internalized into local or state ordinances and review processes. In the Dallas area, the federal requirements are more easily separated and thus it is easier to estimate their costs, since local development reviews are more concerned with expediting project construction.

Finally, Exhibit 6-13 indicates that, as a proportion or project value (on a per unit basis), the costs attributable to federal environmental requirements amount to 6% or less, with one exception. The exception is a Boston case in which a moratorium related to federal water pollution control requirements accounted for 12% of the project's total carrying costs. However, in all of the other cases, federal costs represent less than half of this proportion of the unit's selling price.

6.5.2 Costs Adjusted for Consistency

The adjusted cost scenario was developed to test the sensitivity of the reported costs to assumptions which allow accounting of only those expenditures which are greater than costs ordinarily associated with housing development. In this adjustment, administrative costs remain unchanged. Also, the estimates of indirect costs resulting from pollution control requirements placed on manufacturers of building materials are not affected in this scenario; they remain as reported since the expenditures for building materials remain the same. Inflation costs, however, are only included as they are greater than overall inflation in the economy, as measured in terms of changes in the Gross National Product. Finally, compliance costs are assumed to cover only those measures which are not ordinarily required by local regulations: sanitary and storm water management plans are not counted in this adjustment, since they are routine requirements of all developments; actions taken to elevate property above a 100-year floodplain are included.

This scenario is summarized in Exhibit 6-14. This exhibit shows that the two adjusted cost categories--carrying and compliance costs--are greatly reduced from their reported levels. The relative influence of the four different types of costs also shifts in this scenario: indirect costs account for approximately half of expenditures for all environmental requirements. Carrying and compliance costs together account for practically all of the remaining costs. On average, administrative costs remain relatively minor. These assumptions had the largest effect upon estimated inflation costs. When seen against inflation in the economy as a whole, several projects actually appreciated in value over their planning periods. This in turn reduced the total expenditures for environmental purposes.

It is interesting to note that costs incurred in meeting Federal environmental requirements are a much higher proportion of total environmental costs in this scenario: 65% of the total environmental costs can be attributed to federal requirements under these assumptions. In part, this is due to the relative influence of indirect costs; because of the process by which these estimates were developed, all of the costs in this category are attributable to federal requirements. Also, this scenario removes costs which,

EXHIBIT 6-14

SUMMARY: ADJUSTED COSTS

Case	Administrative		Carrying		Compliance		Input		Total	
	Cost/ Unit	Federal Cost/ Unit	Cost/ Unit	Federal Cost/ Unit	Cost/ Unit	Federal Cost/ Unit	Cost/ Unit	Federal Cost/ Unit	Cost/ Unit	Federal Cost/ Unit
Boston: B1	$640	$ 80*	-$ 10	0	0	0	$ 870	$ 870	$1500	$ 950
B2	270	90*	1640	0	$2880	$2880	1850	1850	6640	4820
B3	410	150*	2610	$870	0	0	980	980	4000	2000
B4	0	0	1100	0	0	0	920	920	2030	920
Dallas: D1	10	10	520	190	0	0	1100	1100	1640	1310
D2	30	30	- 390	-100	0	0	1100	1100	750	1040
D3	0	0	-590	-60	30	30	790	790	230	760
D4	0	0	1940	0	90	90	2900	2900	4930	2990
D5	70	70	1710	510	0	0	140	140	1920	720
AVERAGE	160	50	950	160	330	330	1190	1190	2630	1720

*Estimated from portion of costs in this category incurred to meet specific Federal requirements.

while they may be federally required, are also commonly the subject of local ordinances as well, such as public health ordinances which affect wastewater treatment options. Therefore, this scenario reflects the influence of purely federal requirements to a higher degree than the reported costs summarized above.

6.5.3 Summary

The two sets of costs are summarized in Exhibit 6-15. This exhibit shows that the overall costs as reported in interviews are significant expenditures in terms of the project's value in all cases. This exhibit also indicates that project size or density may affect these costs: the highest per-unit reported costs are found with the lowest density projects in both Boston and Dallas cases, although these are not the largest projects in terms of numbers of units. In general, reported costs attributable to environmental regulations are higher in the Boston area than they are for the Dallas cases. This is due primarily to longer review periods and the involvement of a greater number of agencies in environmental reviews found in the Boston cases than in Dallas. While this may in turn be a reflection of attitudinal differences towards growth and its management in the two areas, it is also a reflection of the relative scarcity of prime buildable land in the Boston metropolitan area. Local officials in the Boston area appeared to be more concerned with impacts of these developments upon the existing community infrastructure than they were in the Dallas area. These concerns are also reflected at the state level by the involvement of several state agencies in development review; in Dallas, the state was not involved at all in reviewing these five projects.

The assumptions used to adjust these costs for consistency tend to soften these regional differences somewhat. With the exception of one case (B2), costs in the Boston and Dallas projects tended to be closer to the mean in this scenario. This is due primarily to the removal of inflation costs that are associated with inflation in the economy as a whole. With the inclusion of only relative inflation, the differences attributable to various review periods are minimized.

EXHIBIT 6-15

SUMMARY OF COSTS
Cost/Dwelling Unit

Case	# of Com-pleted Units	Project Value/ Unit	All Environmental Costs		Federal Environmental Costs			
					Reported		Adjusted	
			Reported	Adjusted	Amount	% of Total Reported	Amount	% of Total Adjusted
Boston: B1	266	$44,300	$12,760	$1500	$2250	18%	$ 950	63%
B2	39	64,600	13,360	6640	3860	29%	4820	73%
B3	172	56,900	15,490	4000	6730	43%	2000	50%
B4	65	67,600	16,710	2030	920	6%	920	45%
Dallas: D1	2200	60,000	2,920	1640	1820	62%	1310	80%
D2	1400	60,000	9,030	750	3240	36%	1040	--
D3	202	59,000	5,320	230	1420	27%	760	--
D4	65	212,000	9,760	4930	2990	31%	2990	61%
D5	110	65,000	3,710	1920	1310	35%	720	78%
AVERAGE		76,600	9,900	2630	2730	28%	1720	65%

Because housing developments are so varied in their design and thus in their costs, the estimated expenditures for meeting environmental requirements drawn from these nine cases cannot be seen as representative of the experience of the entire housing industry. However, some general conclusions can be drawn from these cases about the relative importance of the types of costs of all environmental requirements considered, as summarized in Exhibit 6-16:

Administrative costs: These are the least important of the four types in both scenarios, accounting for 6% of total adjusted environmental costs. While this may be partly due to underreporting, these costs on a per unit basis become negligible when compared with carrying or compliance costs.

Carrying costs: As reported by developers, these play a major role in determining the total level of costs incurred to meet environmental requirements (71% of all reported environmental costs), but these costs are highly sensitive to assumptions about the length of the planning period (or the documentation of true delays caused by environmental reviews). Some of the direct carrying costs can be shifted from the developer to the landowner, simply by not purchasing land outright until all of the necessary permits have been obtained. Such shifts tended to lower cost estimates reported in interviews, and may understate the real level of costs in this category since these direct carrying costs cannot be avoided by all parties.

Inflation is the largest single cost in this category, and makes this category an important factor in determining overall costs. However, when these costs are adjusted to account for inflation in the econcomy as a whole, this type of cost is less significant than originally estimated. Inflation in the homebuilding industry does not appear to be significantly greater than inflation in the economy as a whole. When adjusted costs are considered, the overall impact of carrying costs diminishes greatly--from 71% to 36% of total environmental costs.

Compliance costs: These present the greatest difficulty in attribution. The most expensive items in this category (e.g., sewer systems) have traditionally been considered necessary for protection of public health. The goal of environmental improvement has been added relatively recently. Therefore, these expenditures tend to be minimized by developers, since they are costs which would be incurred in building any development in any part of the country. The real problem then becomes one of marginal attribution: what was required of wastewater management that would have been different in the absence of federal regulations? Interviews used to develop the nine case studies did not provide answers.

Input costs: While these represent a significant portion of costs incurred to meet environmental regulations, they have also been assumed to remain constant in adjustments for consistency, due to the methodology used to estimate them. For the same reason, they are also entirely attributable to federal requirements (rather than to state or local regulations). Thus, their relative importance shifts with assumptions as to the other costs included.

Exhibit 6-16 also shows that the importance of federal environmental requirements in the level of overall costs shifts somewhat as costs are adjusted for consistency. This may be due in part to different perceptions held by developers about the types of expenditures which can be attributed to environmental requirements (and thus what the developers reported in interviews). This finding is reinforced by comparing reported with adjusted federal costs. Twenty-seven percent of the estimated reported costs incurred by environmental requirements can be attributed to federal requirements. Many of the costs dismissed in the adjusted process were non-federal in nature, leaving primarily costs incurred in meeting specific federal requirements (65%). As costs were adjusted for consistency, the importance of the various categories of federal costs shifted; as carrying costs became less important due to consideration of inflation in the overall economy, the relative importance of input costs increased by 25%.

EXHIBIT 6-16

SUMMARY OF AVERAGE CASE STUDY ENVIRONMENTAL COSTS

(Cost/Dwelling Unit)

	Costs Reported by Developers				Costs Adjusted for Consistency			
	Total Reported	% Total Reported	Federal Reported	% Federal Reported	Total Adjusted	% Total Adjusted	Federal Adjusted	% Federal Adjusted
Administrative	$ 160	2%	$ 50	2%	$ 160	6%	$ 50	3%
Carrying	7,060	71%	1,270	47%	950	36%	160	9%
Compliance	1,490	15%	230	8%	330	13%	330	19%
Input	1,190	12%	1,190	44%	1,190	45%	1,190	69%
TOTAL	9,900	100%	2,730	100%	2,630	100%	1,720	100%

In summary, the proportion of environmental costs attributable directly to federal requirements is highly dependent on the assumptions used in preparing estimates--in short, on the types of actions which are included.

A final comment concerns the nature of the regulatory requirements examined in these case studies. While Chapter 3 presents a comprehensive list of regulations which could potentially affect the cost of housing, it is important to note that many of these regulations have yet to be implemented at the local level in such a way that individual projects are affected. The costs which had the greatest impact upon these nine cases stemmed from three requirements:

- Environmental assessment requirements, from the National Enviornmental Policy Act,
- Management of sanitary wastewater from the Clean Water Act, and
- Restrictions upon building in floodprone areas, from the National Flood Insurance Program.

Several types of regulations which had the potential to impact housing development were not found to be important. These included:

- Coastal Zone Management requirements. In Massachusetts, housing has not been a major component of new development in the coastal zone, and Dallas is far from Texas's coast.
- management of nonpoint wastewater, such as federal requirements for stormwater management, from the Clean Water Act. In Massachusetts and in Texas, stormwater has traditionally been a concern of subdivision regulations and is frequently not considered an environmental requirement. Similarly, wetland protection is a state concern in Massachusetts, and federally-sponsored plans which would regulate development in or adjacent to wetlands have not yet been implemented.

- municipal solid waste disposal, as mandated by the Resource Conservation and Recovery Act. In neither the Boston or Dallas areas were cases found that were materially affected by closings of existing dumps or landfills. As suitable disposal sites become more scarce, this may have an impact on housing development costs in the future, but is not a concern of individual developers at present.

- requirements concerning either point or mobile air pollution emissions, from the Clean Air Act. In both the Boston and Dallas areas, housing is not considered to be an important source of either type of air pollution, and is thus not regulated from this standpoint.

While it is possible that these requirements may become more important in determining the costs of building housing in the future, these nine cases were not able to address their present impact. Several cases (primarily those in the Boston area) were affected by state or local regulations which paralleled these federal requirements; their impacts are described above. However, these costs cannot be included in estimates of the impact of present Federal environmental requirements, since they have yet to be implemented at the federal level. As is the case with the issue of wastewater management, some of the federal environmental goals are found in state and local requirements as well: this coincidence of objectives makes an accurate estimation of the impact of purely federal requirements difficult at best.

SECTION THREE

ECONOMETRIC ANALYSIS

CHAPTER 7

ANALYSIS OF SECONDARY DATA

7.0 INTRODUCTION

Case study analysis in the previous section has identified the costs of residential development that are attributable to federal environmental regulations. These results are, in most respects, consistent with those of similar studies. However, the findings of the section are limited in that they cannot be generalized to a broader geographic context. Nor can the research methodology be easily reproduced. As with most research into this subject, substantive empirical results are based upon case studies that have involved the administration of a lengthy survey instrument to developers plus the collection of supplementary data from planning and other relevant local officials, both of which can only be accomplished at considerable expense. These constraints then beg the question: are there alternative research methodologies which can achieve the same objectives more easily and at less expense?

This section investigates one such possibility. It applies an econometric model to secondary data to determine whether such a framework is sensitive enough to detect how environmental reglations, specified in a more generic sense, impact housing costs. It does this by specifying a hedonic price model which uses sales price as the dependent variable and housing and neighborhood attributes, including selected envionmental regulations, as independent variables. Results of the test are interpreted by examining coefficients for sign, magnitude and statistical significance.

Because of the experimental nature of this aspect of the research effort, some limitations are placed on the analysis. Foremost is the set of environmental regulations included in the econometric specification. As the incidence of federal environmental regulations enforced at the local level was found in case studies to be rather unsystematic, regulations explored in this chapter are those that have been applied more or less consistently across the study area, regardless of the level of government which promulgated them. This approach is taken only to assure that meaningful results are obtained from this exercise. If the analysis is successful, further research can refine variable specification to accomodate the needs of EPA. Conversely, if insignificant or indeterminant results are obtained, then by having used the most completely enumerated variable set pertaining to environmental regulations, we may conclude that the approach holds little promise for more relevant model specifications.

This chapter used detailed information on over 1,000 sales of single-family homes in 20 separate jurisdictions in the Boston area to statistically test for the impact of environmental regulation on housing prices. Section 7.1 describes the hedonic price technique to be employed and will discuss previous studies which have employed this technique. Section 7.2 outlines the specific hypotheses to be tested. Section 7.3 presents a description of the data used in the estimation. Section 7.4 contains results and conclusions.

7.1 HEDONIC PRICE INDEX APPROACH

The most unique characteristics of the housing market is the "heterogeneous" nature of the product. When one buys a home, one is buying a "package" of attributes. One buys simultaneously some interior space, a structure of some quality, a number of rooms, admittance to a community, a set of neighbors, a package of public services, etc. Buyers, however, face only "bundle" prices. That is, the individual characteristics are tied together in specific combinations with a single price attached.

A hedonic price index is a statistical tool which can be used to estimate the "implicit" price of each attribute. Estimating these prices is accomplished with multiple regression analysis, with sales price (or rent) as the dependent variable to be explained by a series of independent variables describing the structural and locational characteristics of the unit:

$$V = \sum_{i=1}^{m} PiXi + \sum_{j-1}^{n} PjNj + u$$

Where V = the market price of structural attribute i

Pi = the estimated price of structural attribute i

Xi = the quantity of structural attribute i

Pj = the estimated price of neighborhood characteristic i

Nj = the quantity of neighborhood characteristic i

u = a random error term.

Sherwin Rosen formalized the theoretical basis for these estimations in a 1974 article.[1] Zvi Griliches in 1971 edited a volume of papers which analyzed the theoretical and empirical problems associated with their use.[2] John Kain,

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[1] See Sherwin Rosen, "Hedonic Prices and Implicit Markets," Journal of Political Economy 82: 1 (Jan./Feb. 1974).

[2] Zvi Griliches, ed., Price Indexes and Quality Change, Harvard University Press, 1971.

Mahlon Straszheim and others have made extensive use of the technique to analyze housing markets.[1]

There have been a number of attempts to use the technique to specifically estimate the value of neighborhood or community characteristics including environmental quality, racial composition, tax rates, school systems, zoning regulations, etc. The idea is that by controlling for structural and neighborhood attributes, analysts can isolate the market's implicit valuation of each characteristic separately.

The best known study of environmental quality as a "housing attribute" was done by Ridker and Henning in 1967.[2] Their results suggest that properties located in high sulfation areas sell for significantly less than identical properties in identical neighborhoods with lower sulfation levels.[3]

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[1] See for example John Kain and John Quigley, *Housing Markets and Racial Discrimination*, National Bureau of Economic Research, 1975; Mahlon Straszheim, *An Econometric Analysis of the Urban Housing Market*, National Bureau of Economic Research, 1973.

[2] See R.G. Ridker and V.A. Hening, "The Determinants of Residential Property Value with Special Reference to Air Pollution," *Review of Economics and Statistics*, Vol. 49, 1967, 245-256. Other studies of environmental impacts include M. Edel, "Land Values and the Cost of Urban Congestion: Measurement and Distribution," *Social Science Information*, 10, 1971, pp.7-36; R.V. Anderson and T.D. Crocker, "Air Pollution and Property Values," *Urban Studies* (Oct. 1971).

[3] Their results suggest that a reduction of between 0.25 and 0.49 mg/100 cm^2/day in sulfation levels would increase property values in St. Louis by as much as $82,790,000. This study uses Census data.

The publication of this study touched off a debate in the literature concerning the nature of attribute prices.[1] Polinsky and Shavell correctly pointed out that the estimated attribute prices cannot be interpreted as society's "valuation" of the attribute in question since the adjustment of the housing market to changes in neighborhood characteristics may be complex. An environmental change in one portion of a metropolitan area can have an impact on values in other portions by attracting demand and stimulating changes in the housing stock. Improvements may have significant impacts on overall patterns of residential location, the structure of business districts, and other features of urban areas. They also point out that attribute prices result from both demand _and_ supply factors, a point which will assume larger importance when environmental regulations are discussed below.

Another group of recent papers has used hedonic techniques to estimate the impact of a limited number of location specific environmental regulations on property values. Most of these have focused on zoning regulations and growth control.[1] Peterson points out that restrictions on land use can be expected to have a variety of impacts on land and location values.[2] First, by restricting the movement of land into its "optimal use," the regulation may have a significant negative impact on value. Second, by reducing the available supply of land for new construction, the regulation may serve as a "barrier to entry" increasing the value of existing housing units in the area. Third, the regulation may have a significant impact on the environment which in most cases would enhance locational amenities and, again, increase property values.[3]

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[1] See A.M. Polinsky and S. Shavell, "Amenities and Property Values in a Model of an Urban Area," _Journal of Public Economics_, Vol. 5, 1976, pp.119-129; A.M. Polinsky and S. Shavell, "The Air Pollution Property Value Debate," _Review of Economics and Statistics_, Vol. 57, (Feb. 1975) pp.106-110; Myrick Freeman, "Air Pollution and Property Values: A Methodological Comment," _Review of Economics and Statistics_ (Vol. 53, Nov. 1971); Myrick Freeman, "On Estimating Air Pollution Control Benefits from Land Value Studies," _Journal of Environmental Economics and Management_, Vol. 1, 1974, pp.74-83.

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[1] See, for example, George Peterson, "The Effects of Zoning Regulations on Suburban Property Values," The Urban Institute, Working Paper #1207-24, March 1973; S. Schwartz, D. Hansen, R. Green, W. Moss, R. Belzer, "The Effect of Growth Management on New Housing Prices: Petaluma, California, Institute for Governmental Affairs, University of California at Davis, July 1979; William Moss, "Large Lot Zoning, Property Taxes and Metropolitan Area," Journal of Urban Economics, April 1976, pp.408-427; Arthur Solomon, "The Effect of Land Use and Environmental Controls on Housing: A Review," Joint Center for Urban Studies of Harvard and M.I.T., Cambridge, MA, Feb. 1976.

[2] Land is an input into the production of new housing and location is an attribute of the housing bundle. Locational characteristics (which affect demand) and supply factors determine the market prices of new and existing housing.

[3] The point of growth control in most areas is environmental improvement. This raises an important issue with regard to inflation. If the regulations significantly improve amenities then observed increases in price reflect an increase in quality; inflation is an increase in the price level where the quantity of goods remains constant.

The relative sizes of these impacts will depend in large measure on how widespread their use is and on general housing market conditions. In California, where growth control legislation is widely used and where the demand for housing has been increasing rapidly in recent years, the impacts seem to have been quite significant.[1] Peterson finds that while the positive impacts on housing prices in suburban Postor outweigh the negative, there is a significant negative effect resulting from the land use constraint.[2]

The most significant problem encountered in all previous studies is omitted variable bias. It is impossible to accurately "control" for all locational characteristics which affect the value of housing. When a variable which does affect value is left out and is, in addition, statistically associated with an included explanatory variable, a bias results. For example, if towns with two acre minimum lot zoning generally have beautiful woods to protect, it may be impossible to separate statistically the value of the woods from the restrictionary impact of the zoning regulation on property values. As a result, interpretations must be made with extreme caution.

7.2 SPECIFIC HYPOTHESES TO BE TESTED

The model to be estimated will attempt to isolate the independent impacts of four specific regulations on property values:

(1) Minimum Lot Size Zoning Restrictions: These are imposed by local jurisdictions to restrict growth and maintain open space.

(2) Participation in the National Flood Insurance Program (Regular Phase): Communities which qualify must establish certain controls in the flood plain including: a permit process for new development; required elevation for new residential structures above the flood plain; required waterproofing for new utilities; no development which would raise the base flood by more than one foot.

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[1] See Schwartz, et.al., op.cit.

[2] Peterson, op.cit., p.25.

(3) Special Zoning for Planned Unit Development (PUD): In order to promote the more efficient use of land, developers in certain communities may submit an application to a community's Board of Appeals for a special permit exempting a proposed development from the community's zoning by-laws. The exemption may pertain to lot size, usable land area, density or percentage of lot covered, etc.

(4) Erosion/Wetlands/Watershed Protection: The Wetlands Protection Act of 1972[1] is designed to protect any inland or coastal land which is subject to coastal storm flowage, flooding or tidal action. The Act requires all communities to assess the potential for adverse effects on any wetlands region. Local conservation commissions may impose upon any developer in a wetland area an "Order of Conditions" that must be followed to maintain the integrity of the wetlands area.

The model to be estimated assumes that single-family home prices are a function of: (1) the structural characteristics of the dwelling unit itself; (2) the characteristics of the neighborhood; and (3) whether any or all of the four types of regulations have been applied in the jurisdiction where the sale took place.

Estimation of a hedonic price index with all three kinds for variables included will permit statistical tests for the influence of the environmental restrictions on property values ceteris paribus. For example, do properties in towns with special zoning of PUDs sell for more or less than identical properties in identical jurisdictions with no such restrictions? Interpretations of the results must be made with caution in light of the theoretical debate discussed above. The coefficients on the environmental regulation in the estimated equations will give a first order approximation of the net difference in housing prices across jurisdictions with different regulations.

Assuming that housing markets are competitive, and that jurisdictions in the sample are part of the same housig market, regulations such as those discussed above can be expected to affect prices in several ways. Minimum lot size restrictions are usually designed to restrict growth and maintain open space. The restriction itself must reduce the value of parcels which would have been developed at lot sizes below the imposed minimum. The whole point of the legislation, however, is to enhance (or prevent the deterioration of) the environment of the present homeowners in the jurisdiction. The zoning regulation has the effect of preventing the inflow of capital, restricting the supply of housing and driving up property values.

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[1] Massachusetts General Laws, Chapter 131, Section 40.

Note the increase in housing prices in the jurisdiction in question is reflective of an increase in environmental quality (or of assurance that the environment will not deteriorate). In some cases it can be shown that the gains to existing residents exceed the losses to owners of parcels which otherwise would have been developed. In Lincoln, Massachusetts, the town is simply bying up all the available open space at prices attractive to the owners and holding it open.

Left out of this calculation is the fact that the supply restriction imposed in the zoned jurisdiction increases the residual demand for properties in the rest of the surrounding housing market. If the number of jurisdictions imposing restrictions is small, the overall impact on housing prices will be minor. Obviously, if all jurisdictions in a metropolitan area restricted the expansion of housing, land and housing prices would be pushed up significantly and land in agricultural production would be converted to residential use. Differences in housing prices which arise between jurisdictions that do and do not impose minimum lot size restrictions represent, therefore, the net impact of the restrictions.

Communities which participate in the National Flood Insurance Program must establish certain controls in the flood plain. As in the case of minimum lot size zoning, there may be several effects. First, the restrictions such as required elevation, may increase construction costs and put supply side pressure on local housing prices. Second, by increasing community and builder consciousness of potential flood problems, the regulation may repel potential demand and actually reduce the demand for housing in the area. Third, any restriction which reduces the supply of developable land in a jurisdiction may have the effect of causing existing home prices to rise. Finally, restrictions which preclude land from being used in the most profitable way (from the private developer's perspective) will lower the bid of potential developers for the location.

An identical story can be told about property value adjustments in communities which come under the Wetlands Protection Act. That is, imposition of the "Order of Conditions" may (1) raise construction costs, (2) increase awareness of potential wetlands problems, (3) reduce the supply of developable land, or (4) restrict land from being used in the most profitable way. The net impact of such restrictions on local land and housing prices is, thus, ambiguous _ex anti_.

It would be surprising if the existence of "special zoning for planned unit development" had a significant impact on property values. Since it is not a restriction, it cannot serve as a barrier to entry. In theory, it would only be exercised when a development was deemed to "enhance" the environment. It could, thus, result in enhanced property values, but _only_ if the development which was granted such approval actually improved the community. Here again, such a price increase would result from the improved quality of the housing bundle, not simply inflation of prices.

It should be noted at the outset that if housing markets are competitive, there is no reason to segment the sample of sales between new homes and existing homes. Home builders and developers sell new homes for "whatever the market will bear," not a mark-up on construction costs.

It is correct, of course, that an environmental regulation which raises construction costs may reduce the supply of new units and drive up prices. If, however, housing producers are currently earning above-normal profits (quasi rents) the increased constructon costs will simply cut into profits and will not raise selling prices.

Another way of looking at the relationship between new and existing home prices is that the cost of construction serves as a constraint on existing home prices and vice versa. When existing home prices rise above the cost of constructing a similar home, the construction industry will respond. Similarly, if the price of existing homes falls below construction costs, housing construction will slow or stop entirely. Newly constructed homes will not sell until their prices fall to the level of comparable existing homes.

7.3 THE DATA

To estimate the hedonic model discussed above, data on individual single-family home sales was obtained from the Society of Real Estate Appraisers (SREA) Market Data Center in Arcadia, California. The SREA is a national association of real estate officers whose membership includes individual real estate brokers, bank and savings and loan appraisers, as well as state and local officials concerned with property appraisal.

While SREA has been collecting market data since 1972, it has only been active in the Boston area since 1979. The data contain information on a total of 7,593 sales of single-family homes completed in the Boston area between January, 1979 and June 1980. From all jurisdictions represented in the full sample, a subset of twenty jurisdictions was chosen on the basis of (1) number of sales, (2) variation in environmental rules, and (3) reasonable proximity to the City of Boston.[1] Exhibit 7-1 presents the jurisdictions and the number of observed sales in each.

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[1] The procedures used to select the subsample was not strictly random; however, as long as sufficient variation in environmental regulations exists within the subsample, and as long as all jurisdictions are within the same market area, estimates of coefficients should be unbiased.

EXHIBIT 7-1

JURISDICTIONS SELECTED FOR HEDONIC PRICE ANALYSIS

Community	Number of Observations	Community	Number of Observations
Ashland	30	Norwell	27
Braintree	64	Pembroke	59
Cambridge	95	Plymouth	261
Duxbury	86	Quincy	198
Framingham	111	Randolph	41
Holliston	27	Reading	33
Lexington	32	Scituate	47
Marshfield	154	Sharon	37
Milton	82	Wellesley	28
Natick	56	Woburn	27

Total 1465

The SREA data contain information on a large number of structural characteristics for each sale. In some cases, the information was misrecorded or not filled in on the submitted forms. In addition, lot size was reported in several forms and conversions were required. Data cleaning reduced the number of observations from 1465 to 1016. Exhibit 7-2 presents the means and standard errors for all variables used.

Since the model will attempt to control for both structural and neighborhood attributes, information on jurisdictional characteristics was obtained from a number of sources and merged with the micro data on structural characteristics. Exhibit 7-3 presents weighted means, standard errors and ranges for all included neighborhood characteristics.

The four environmental regulations to be studied were entered into the equation as dummy variables. For example, the variable "flood" is a "1" for all sales in jurisdictions participating in the National Flood Insurance Program and "0" otherwise. Exhibit 7-4 summarizes the distribution of sales in the sample across those jurisdictions.

7.4 RESULTS

Exhibit 7-5 presents the results of the empirical estimates. Unfortunately, theory tells us very little about the nature of functional relationships among the attributes of a housing bundle. As a consequence, two alternatives were estimated: a linear model and a semi-log model.

Coefficients on variables in the linear model can be thought of as implicit attribute prices in dollars. The linear model assumes that the "price" of an attribute is independent of the total value of the property. For example, an additional bathroom adds $9,703 to the value of a home ceteris sanbus, regardless of its total price.

EXHIBIT 7-2

MEANS AND STANDARD ERRORS OF INCLUDED VARIABLES
(N = 1016)

	Mean	Standard Deviation
Sales Price ($)	56,970	25,051
Lot Size (sq. ft.)	16,470	13,261
Number of Rooms (#)	6.48	1.47
Number of Bedrooms (#)	3.13	0.88
Number of Bathrooms (#)	1.27	0.53
Number of Half Baths (#)	0.42	0.53
Interior Space (sq. ft.)	1,446	615
Year Built (1900=00; 1971=71 etc.)	58	24
Quality of Construction (1-5; 5=best)	3.30	0.62
Condition (1-5; 5=best)	3.42	.82
Number of Fireplaces (#)	0.82	0.70
Swimming Pool (1=yes; 0=no)	0.02	0.12

EXHIBIT 7-3

NEIGHBORHOOD CHARACTERISTICS: WEIGHTED MEANS, STANDARD ERRORS AND RANGE

	Mean	Standard Deviation	Minimum	Maximum
Effective Tax Rate (1980)	44.26	11.22	31.22	70.28
Driving Time to Boston (minutes)	31.8	9.0	15	45
Total Per Pupil Expenditures($)	1852	426	1382	3371
Population Density (per sq. mi.)	2601	3250	191	16,058
% Single-Family Units	72.1	21.8	11	96
Median Income ($,1969)	12,226	2107	9510	19,401

Sources: Population Density, % Single Family & Median Income, 1970 Census of Population on Housing. Effective property tax rate for Fiscal 1980, from calculations performed by the Massachusetts Taxpayers Foundation. See Universal Atlas of Metropolitan Atlas of Metropolitan Boston and Eastern Massachusetts, p. 204.

School Expenditures for year ending June 1978 from the Massachusetts Department of Education, cited in Universal Atlas, pp. 204-205.

EXHIBIT 7-4

ENVIRONMENTAL REGULATIONS: DISTRIBUTION BY JURISDICTION

Regulations	# of Jurisdictions	% of Observations
(1) 1-2 acre minimum lot zoning	4	26.2
(2) National Flood Insurance: Regular Phase	14	79.4
(3) Special Zoning for PUD	8	37.8
(4) Erosion Wetlands Watershed Protection	17	74.7

EXHIBIT 7-5

LINEAR AND SEMILOG ESTIMATES OF HEDONIC PRICE INDEXES

N = 1016

	Linear		Semilog	
	$\hat{\beta}$	t-statistic	$\hat{\beta}$	t-statistic
Lot Size (sq. ft.)	.256	6.99*	.0000048	7.83*
Number of Rooms (#)	279	.52	.036	3.90*
Number of Bedrooms (#)	36	.04	-.002	.20
Number of Bathrooms (#)	9,703	9.97*	.103	6.24*
Number of Half Baths (#)	4,202	4.91*	.082	5.64*
Interior Space (sq. ft.)	10.93	10.66*	.000081	4.68*
Year Built (1900=0; 1971=71)	38.7	2.05**	.0015	4.75*
Quality of Construction (1-5; 5=best)	2,114	2.60*	.037	2.68*
Condition (1-5; 5=best)	4,438	7.37*	.112	11.01*
Fireplaces (#)	6,573	10.44*	.095	8.93*
Pool (1=yes; 0=no)	-2,622	.86	.0064	.04
Local Tax Rate (per $1100 Mkt. Val.)	-903	6.07*	-.015	5.79*
Driving Time (minutes)	688	5.60*	.0039	1.89
Per Pupil Expenditures ($'s)	-5.50	1.05	-.00021	2.38*
Population Density (pop/sq.mi)	5.19	7.55*	.000074	6.37*
% Single-Family	-158	3.36*	.0015	1.82
Median Income ($'s)	4.11	6.99*	.000072	7.27*
Flood Insurance PGM (1=yes)	-1,062	.79	-.112	4.92***
Wetlands Protection (1=yes)	-9,985	2.94***	-.236	4.13***
Large Lotsize Zoning (1=yes)	2,311	2.17****	.042	2.36****
Special Zoning for P.U.D. (1=yes)	-5,573	1.59	-.051	1.93
Constant	23,241	--	9.82	--
R^2	.77	--	.74	--

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*One tailed t-test significant at the 1% level.

**One tailed t-test significant at the 2.5% level.

*** Two tailed t-test significant at the 1% level.

****Two tailed t-test significant at the 5% level.

Coefficients on variables in the semi-log model can be thought of as the percent by which a one-unit change in the attribute will raise prices. Here, the implicit attribute price is not independent of total value. For example, an additional bathroom can be expected to raise the value of a house by 10.3%.

Overall, the equation works quite well. Depending on which of the two forms is selected, there are either 11 or 13 structural and neighborhood variables significant at the 1% level. The R^2's suggest that the models explain between 74 and 77 percent of the total variation in sales price. While there is evidence of some collinearity among the four "room" variables, nearly all structural characteristics have the predicted sign and reasonable magnitudes.

Among the neighborhood characteristics, only three are powerfully significant in both functional forms. Two of the three have the predicted effects and the third is fairly easy to explain. Local tax rates are negatively associated with property values.[1] Towns with higher per capita incomes have higher property values than towns with otherwise identical housing and neighborhood stocks.

While density was considered a "negative" attribute, there is an identification problem. Simple economic models (Muth, Mill, Alonso, etc.) suggest that both land prices and optimal density will decrease as one moves from the central city outward. Thus, there is reason to suspect a strong positive association between them which seems to have swamped the "negative" influence of high density on price.

Exhibit 7-6 presents a summary of the results of hypothesis tests on the four environmental variables. Since the sign of the net effect is difficult to predict in each case, two tailed t-tests were performed in all four.

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[1] This is consistent with previous studies of tax capitalization. See for example Karl A. Case, Property Taxation the Need for Reform, Balinger Press, 1978, especially Chapter IV which presents a survey of the literature.

EXHIBIT 7-6

SUMMARY OF ESTIMATED ENVIRONMENTAL REGULATION IMPACTS

	$ Premium	t	% Premium[1]	t
Flood Insurance Plan	-1,062	.79	-10.6	4.92*
Wetlands Protection	-9,985	2.94*	-21.0	4.13*
Large Lotsize Zoning	+2,311	2.17**	+ 4.3	2.36**
Special Zoning PUD	-5,573	1.59	- 5.0	1.93

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[1] Percent premium is $\frac{\text{P Reg}}{\text{P Unreg}} - 1$ where P Reg is the price of housing in the regulated area and P Unreg is the price in the non-regulated area. It is calculated by transforming the semilog regression coefficient.

If the regulation in question is reflected by a dummy variable with coefficient , we know

$$\text{LOG P Reg} = \Sigma\beta iXi + \gamma$$

$$\text{LOG P Unreg} = \Sigma\beta iXi$$

Thus,

$$\text{LOG P Reg} - \text{LOG P Unreg} = \gamma$$

Thus,

$$\frac{\text{P Reg}}{\text{P Unreg}} = e^{\gamma}$$

and, $\frac{\text{P Reg}}{\text{P Unreg}} - 1 = \underline{e^{\gamma}-1}$

*Two tailed t-test significant at the 1% level.

**Two tailed t-test significant at the 5% level.

The easiest result to explain is that for large lot size zoning, which is consistent with the results of previous studies. On net, the equation suggests that large lot zoning seems to increase housing prices by about 4.3% (semi-log) or by $2,311 (linear) on a single-family home. The variable is significant and positive in both equations. In relating the result to "inflation," it should be noted that it represents a 4% increase in those areas alone. In addition, that net increase is a one time only increment; it is not an annual increase of 4.3%. Finally, it should be recalled that, associated with that increase is an increase in the quality of the housing bundle for community residents.

Housing in communities with special zoning for planned unit developments (PUD) does not seem to be selling for prices above those in other areas. This is consistent with the discussion above which suggested that any effects would be small.

The most puzzling result is the large negative coefficient on the "wetlands protection" variable which is significant at the 1% level in both specifications. It suggests that housing in towns which are subject to the provisions of the Wetlands Protection Act seem to be selling for 21% less than comparable housing elsewhere. Exhibit 7-4 indicates that 17 of the twenty towns in the sample do in fact have wetlands zoning restrictions. If there were some positive factor associated with the three towns which do not have such zoning restrictions, and if those factors were left out of the equation, the wetlands zoning variable would be negative and significant. Thus, the seemingly strange estimate could be the result of omitted variable bias.[1] It is clear that the likelihood of omitted variable bias is quite high when the number of towns in the "control group" is small.

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[1] The three towns are Cambridge, Natick and Quincy; all three are near centers of employment. Cambridge and Quincy are developed at significantly higher densities than the rest.

A similar result was obtained on the flood insurance variable, although it is only significant in the semi-log equation. Properties in jurisdictions which participate in the National Flood Insurance Program seem to sell for about 10% less than identical houses in areas which do not. Once again there is the possibility of omitted variable bias.

An interesting possibility in the last two cases is that the programs (wetlands and flood) in question are designed to deal with a "negative" environmental quality. Since only those towns with that quality will have the regulation, there would be no way to separate the negative impact of the quality from the positive impact of the regulation.

7.5 CONCLUSIONS

The statistical analysis presented here provides little evidence that the environmental regulations in question have served to significantly increase the price of housing in the jurisdictions where they are imposed. Only the imposition of large lot zoning requirements seems to have increased prices; its effect seems to have been small (4.3%).

The fact that the equations show evidence of lower prices in some regulated areas seems to illustrate two important points. First, environmental regulations are enacted to alter the environment and since the environment (broadly defined) can be thought of as part of the housing bundle, an analysis of selling prices cannot entirely separate the effects of a regulation on the quality of housing from its effects on the price of housing.

Second, since regulations are often enacted to deal with negative environmental qualities which themselves tend to suppress land values, statistical analysts might be tempted to attribute the lower prices resulting from the negative attribute to the presence of the regulation. The regulation itself may in face have increased prices above their already suppressed level.

SECTION FOUR

CONCLUSIONS

CHAPTER 8

SUMMARY AND CONCLUSIONS

8.0 INTRODUCTION

This research effort was undertaken for two distinct purposes. The first was to add information to the growing data base concerning the impacts of environmental regulations on housing costs. In this effort, the study focused primarily on environmental regulations emanating from the federal government, and emphasized costs traditionally borne by the housing developer, although it has been shown that both homeowners and government agencies also bear regulatory costs. The second purpose concerned the applicability of housing cost impact analysis techniques to a broader assessment of environmental regulations.

As described in the bulk of this report, these goals were met through the use of two different research approaches. The first approach used nine case studies to document the experience of developers in two metropolitan areas with various environmental requirements. The second used a econometric approach and secondary data describing characteristics of recently-sold housing to assess the relative importance of different types of environmental regulations in determining housing prices. This chapter summarizes the findings of the two approaches, and discusses the feasibility of their application to questions of regulatory impacts on a broader scale.

8.1 SUMMARY OF THE CASE STUDY APPROACH

The nine case studies provide strong evidence that the approach taken to implement mandates of federal environmental laws has a significant impact on the types as well as levels of incurred costs. As these cases point out, many federal environmental requirements are implemented by state and local governments, as well as by federal agencies. The regional differences in costs incurred by Boston and Dallas developers illustrate the relative impacts of different institutional frameworks for environmental regulation.

The case studies point out that the way costs are accounted is also important in determining true impacts. As noted in Chapter 6, some general conclusions can be drawn about the relative importance of different types of costs. Administrative costs were found to be the least important of the four types examined; and, in general, the costs of studying environmental issues (where the studies are mandated by environmental requirements) is usually much less than the costs of solving the problems identified. Carrying costs can be shown to be one of the most important (under some assumptions) and have been shown in most studies to be the most significant of the four cost components, as well as the most difficult to estimate with any accuracy. These costs are perhaps the most dependent on the assumptions used in the analysis--e.g., whether inflation is accounted in just the building industry or the economy as a whole, and how the concept of regulatory delay is defined. For example, this study used the entire length of a project's planning period, since the interviews did not produce any consistent estimates of expectations (on the part of either developers or officials) concerning a reasonable period for reviews. In terms of overall cost levels, expenditures for compliance represented another significant category for the nine cases where costs for meeting all environmental requirements were considered. Finally, input or indirect costs were also found to be a major cost factor; in all scenarios, these costs represented a significant portion of all costs incurred to meet environmental regulations.

The case studies also indicate that the proportion of costs incurred to meet federal environmental requirements is similarly dependent upon assumptions concerning the implementation of these requirements. Of the costs reported in interviews with developers, less than one third could be directly attributable to requirements which were implemented specifically by the federal government. On a per-unit basis, the cases averaged approximately $2700 for federal environmental requirements, out of a total expenditure of almost $10,000 (as described in Exhibit 6-16). However, assumptions which tended to minimize costs attributed to environmental requirements in general tended to increase the proportion of costs which could be attributed to the federal government: in this scenario, fully two-thirds of costs incurred to meet all environmental regulations could be considered federally-mandated. The distribution of costs among the four types was found to be the same for federal as for all environmental requirements. In none of the nine cases did federal environmental costs exceed 5% of the per unit project value.

Aside from the actual levels of costs incurred to meet environmental requirements, a second major finding of the case studies concerns the laws and regulations which were found to actually touch the development process. Chapter 3 presents essentially a laundry list of all of the federal laws which could have an effect upon housing development. These case studies, which were selected because there was a high probability that environmental requirements had affected them, indicated that only three of the eight laws resulted in costs directly attributable to federal requirements. These were:

- environmental assessment requirements stemming from the National Environmental Policy Act,
- management of sanitary wastewater, stemming from the Clean Water Act, and
- restrictions upon building in floodprone areas, from the National Flood Insurance Program.

Three laws which were thought to have some impact on housing development, were found to have no real effect in either the Boston or Dallas areas. The Coastal Zone Management Program in Massachusetts has not affected housing developments in the state's coastal zone, since very little residential development is taking place there. Dallas, of course is far from the coast, and so would not be affected at all. The Resource Conservation and Recovery Act was also found to have no discernable effect on housing development costs, although this could change as more of the legislation's requirements are implemented. Neither did the Clean Air Act directly affect housing development in either Boston or Dallas, either through regulation of houses as stationary sources of pollution (e.g., through furnaces or fireplaces), or through regulation of these developments as generators of traffic and thus mobile sources of pollution. Both RCRA and the Clean Air Act have have and are expected to have a greater impact upon the cost of producing building materials. However, in terms of their direct impacts upon the development of housing, these laws had little or no impact.

Some environmental concerns were found to be costly as they related to housing development, but were found to be tangentially related to federal environmental mandates at the time in which these projects were being planned and constructed. For example, the management of stormwater drainage, which is classified as a nonpoint source of water pollution, could be considered to be a subject of federal regulation as plans for nonpoint source management are developed under Section 208 of the Clean Water Act. However, in both Massachusetts and in Texas, stormwater has traditionally been a concern of subdivision regulation at the local level, and is frequently not considered to be an environmental requirement *per se*--to the point where developers did not mention stormwater management costs as environmental expenditures during the interviews. While stormwater may be more directly regulated by the federally-sponsored planning efforts in the future as the 208 plans are implemented, it is not now considered to be a direct federal concern.

At the same time, several requirements mandated by legislation which was not originally drafted for the primary purpose of environmental protection are considered by developers to be implemented for this end. One example is the Flood Insurance Program, which was originally formulated as a safety and property protection initiative; this program has had a significant impact on the ways in which land can be used in communities which participate in the program.

Perhaps the major finding of these cases is the importance of the implementation of these laws in determining costs. The manner in which they are implemented can have as great an effect as the actual physical requirements which result. For instance, the Boston and Dallas case point to the significance of participation by state and local agencies as well as the relevant federal actors in the development process. In the Boston area, many of the federal environmental mandates are in fact carried out by the state or local governments. The environmental assessment process is a good example: in Boston, these reviews are the province of the state, while in Dallas the federal agencies have responsibility. While the case studies indicated that impact statements in both areas resulted in roughly similar project costs, the Dallas reviews took less time to complete. Development in the Boston area is greatly affected by the participation of more agencies in reviews; delays are exacerbated as reviews are conducted at several levels of government as well.

Another factor may also be the level of professionalism brought to the development process. In Boston, the cases were reviewed and approved at the local level primarily by boards for which citizens donate time. In Dallas, the reviews were conducted at the local level by full-time city or town staffs, who may be better able to identify potential problems quickly and negotiate solutions with the developer. Development in Boston is more of an adversarial process; this in turn contributes to longer review periods.

Finally, the nine cases taken together provide some evidence for differences in attitudes between the two areas. The development process in the Boston area provides many opportunities for public intervention, and some have argued that the process emphasizes an attitude which is opposed to new development generally. In Dallas, the cases appear to have benefited from an attitude which is more favorable to development, and which provides developers with more flexible approaches for working out environmental problems. While only one of the nine cases (B1) provided a situation in which abutters clearly used the available environmental regulations to attempt to stop a project which they opposed on social (non-environmental) grounds, the fact remains that it is easier to do this in Massachusetts than in Texas. These attitudes tend to be reflected at the state level as well. In short, the degree to which federal environmental regulations affect the development process depends to a large extent upon how the process itself and the environmental mandates are administered at the local level as well as the ambient physical context in which the project is to be located.

8.2 SUMMARY OF THE STATISTICAL ANALYSIS

The statistical analysis presented in Chapter 7 examined four types of environmental variables in relation to a variety of other house and neighborhood characteristics to determine the relative importance of each in the price of housing. The four environmental variables were:

- large lot zoning,
- special zoning for planned unit developments,
- wetlands protection requirements, and
- participation in the flood insurance program

Of these four variables, only the special zoning for planned unit developments is completely disassociated from federal environmental mandates; this type of ordinance is entirely a local initiative. The remaining three variables all have at least the potential to be categorized as federally-mandated solutions to environmental problems. Participation in the flood insurance program is the one requirement of the four that results directly from federal legislation.

The statistical analysis provided evidence that these variables do not all have similar effects upon the price of housing. Large lot zoning was the only one of the four variables to show a positive impact on housing prices--that is, housing sales prices were higher in communities with this requirement. The presence of this requirement, which can be used as an alternative to providing a sewerage system, increased the sales prices of housing by more than $2300.

Both wetlands protection and flood insurance requirements exhibited negative coefficients with respect to housing prices. This relationship was found to be statistically significant especially for wetlands protection, where the presence of this type of regulation decreased the price of a house by 21%. Properties in communities participating in the National Flood Insurance Program were found to have sales prices which were approximately 10% below prices for houses in communities which were not participating. For both of these variables, the analysis suggests that the conditions which the requirements are designed to improve may themselves tend to depress the price of housing in a community. While the regulations are associated with lower sales prices, it is possible that these prices would be still lower in the absence of the regulations. The analysis also suggests that it is not possible to separate these effects statistically with the data used in this study.

Finally, the analysis showed that the presence of a local ordinance requiring special zoning for planned unit developments had little if any impact upon sales prices of housing. That is, houses with similar characteristics were selling for roughly similar prices in communities with and without this type of ordinance.

This analysis was generally limited in determining the proportion of the price effects found for three variables which could be attributed to federal regulations rather than local ordinances. The use of Massachusetts data may have complicated this extension of the analysis, since each of the variables involves a different degree of federal intervention in an extremely complex development process. The variable which is most directly attributable to federal requirements is participation in the National Flood Insurance Program, in which insurance is subsidized by the Federal Emergency Management Agency while communities themselves decide how to manage development of their floodplains. Large lot zoning could be construed to be a federal environmental mandate only in areas where water pollution problems can be clearly attributed to failing septic systems; larger minimum lot sizes may be required to allow sufficient space for alternating leaching fields, for instance. However, this connection is tenuous at best. Many large lot zones are drawn to protect local aesthetic values (e.g., a rural community character) or to preserve a social ambience (in that larger lots are more expensive than smaller ones). Finally, wetlands protection is implemented at the local and state levels of government in Massachusetts, through the combined efforts of local Conservation Commissions and an appeals process to the state. As with the case studies which encountered this requirement, protection of wetlands from residential development has been studied in 208 plans required by the Clean Water Act, but has largely not been directly implemented at the federal level.

8.3 CONCLUSIONS

While an examination of the literature shows that environmental regulations attributable to all levels of government have been investigated in some depth, there has been no systematic evaluation of the extent to which a given level of government is responsible for the environmental costs borne by the consumers of new housing. Accompanying much of the literature, particularly in research sponsored by construction industry associations, have been calls for regulatory reform to reduce development costs. These calls appear to be particularly unfocused in terms of both the appropriate level of government and specific regulatory programs, given the absence of attribution in most of the studies reviewed.

Of the eight major federal environmental laws, only housing cost impacts of provisions of the National Environmental Policy Act and the Coastal Zone Management Act have been investigated in the literature. Therefore, Section 1 of this report describes theoretical cost impact chains for all eight of the major federal laws. The case studies which follow represent an attempt to trace these linkages empirically.

The case study analysis concerned two metropolitan areas--Boston and Dallas--that differed markedly in terms of population growth, environmental background, political background and attitudes toward growth. These case studies supported the findings found in the literature: with respect to environmental regulations, costs are highly dependent upon the characteristics of the proposed development, the ambient environmental background in which it is to be situated, and perhaps most importantly, the political and administrative context in which the development must be reviewed. Despite the advantages of this approach in providing empirical documentation of impacts, case study techniques have typically precluded generalizing cost estimates beyond the local context to which they apply.

Other difficulties with the case study approach involve the reliability of accurate data concerning incurred costs. The method used in this research involved collecting data concerning all development costs from planners and builders, with attribution of costs to various regulations undertaken by the researchers. However, for many cases, detailed data were not available--either because the developer did not maintain full files on completed projects, or because this type of data was not developed at all. In addition, questions of project timing were found to be open to some dispute: what a developer may call a regulatory delay was considered by the Town Planner to be part of the community's normal review process. Frequently, these discrepancies are irreconcilable. In spite of these shortcomings, though, the developers who agreed to participate were as helpful as possible, and they supplemented their files through sometimes extended interviews. Nonetheless, this approach remains extremely localized and research-intensive.

In an attempt to generalize the findings of these nine case studies, the research effort took a second approach to estimating regulatory costs. Two versions of a hedonic price model were constructed which related the sales price of a house to variables representing the environmental policies of the community in which the dwelling is situated. The models were estimated upon data that were available from secondary sources, except for regulatory data that were collected as part of the case analysis. Estimation results did not produce consistent evidence that regulatory variables of an environmental nature increase the price of housing.

However, as the analysis revealed several anomalies in the data, these results must be interpreted with caution. Measurement difficulties precluded the incorporation of many regulatory variables into the econometric specifications. Furthermore, those that were specified were represented only as dummy variables, indicating regulatory incidence in the community rather than specific regulatory provisions. Omitted variable bias could be obfuscating severely the true impacts of these regulations. Based upon limited empirical evidence, development of a model to estimate the impacts of environmental regulations on housing costs is expected to reap limited dividends. The extremely local nature of environmental impacts, problems of variable specification (particularly with respect to environmental regulations at all levels of government), and the sheer complexity of the relationships involved in the development process are limiting factors which can only detract from such a model's abilities.

Clearly, the results of this research effort are not definitive, as it has examined only a small number of developments in two metropolitan areas to substantiate its conclusions. However, its results are suggestive of the complex interrelationships among local, state and federal regulations which interact with the private land development process, and of the difficulties in winnowing out only the federal contribution to the impacts of these regulations on housing costs.

APPENDICES

APPENDIX A

BIBLIOGRAPHY

Anderson, R.V. and Crocker, T.D. "Air Pollution and Property Values," Urban Studies, October 1971.

Californians for an Environment of Excellence, Full Employment and a Strong Economy Through Planned Development (CEEED), The Housing Crisis: The Cause and What We Can Do About It, Newport Beach, California, 1980.

Case, Karl A. Property Taxation, the Need for Reform, Balinger Press, 1978.

Construction Industry Research Board, Cost of Delay Prior to Construction, Los Angeles: Construction Industry Research Board, April 1975.

Council on Environmental Quality, Environmental Quality - 1979. Washington, D.C., Executive Office of the President, 1980.

Data Resources, Inc. The Macroeconomic Impact of Federal Pollution Control Programs: 1978 Assessment. Submitted to the U.S. Environmental Protection Agency and the Council on Environmental Quality, January 1979.

Edel, M. "Land Value and the Cost of Urban Congestion: Measurement and Distribution," Social Science Information, 10, 1971, pp.7-36.

Freeman, Myrick. "Air Pollution and Property Values: A Methodological Comment," Review of Economics and Statistics. Vol. 53, November 1971.

Freeman, Myrick. "On Estimating Air Pollution Control Benefits from Land Value Studies," Journal of Environmental Economics and Management, Vol. 1, 1974, pp.74-83.

Frieden, Bernard J. The Environmental Protection Hustle. Cambridge, Mass.: MIT Press, 1979.

Gobar, Alfred and Associates. Housing Cost Analysis: Orange County, Brea, California, 1980.

Grilickes, Zvi. ed. Price Indexes and Quality Change, Harvard University Press, 1971.

James, Franklin J., and Muller, Thomas. "Environmental Impact Evaluation, Land Use Planning, and th Housing Consumer," AREUEA Journal, Vol. 5, 1977, p.283.

Kain, John and Quigley, John. Housing Markets and Racial Discrimination, National Bureau of Economic Research, 1975.

Levine, Bernard and Colgan, David L. "The Effect of Environmental Impact Statements on the Real Estate Investment Trust Industry," Urban Lawyer, 1974.

Lincoln, James R., Jr., Coddington, Dean C., and Peuberthy, John R. An Analysis of the Impact of State and Local Government Intervention on the Homebuilding Process in Colorado, 1970-1975. Denver, Colorado, April 1976.

Massachusetts Coastal Zone Managment Program and Final Environmental Impact Statement. Prepared by the Executive Office of Environmental Affairs, Boston, Massachusetts, 1978.

Massachusetts Executive Office of Communities and Development, Compendium: Developing Coordinated Local Permitting System, April 1979.

Moss, William. "Large Lot Zoning, Property Taxes and Metropolitan Area," Journal of Urban Economics, April 1976, pp.408-427.

"NAHB Multi-Scale Survey of Development Costs: Regulation Price Tab Varies from $2961 to $6841 Per Lot," Professional Builder, March 1978.

The Nation's Housing: 1975-1985. Joint Center for Urban Studies of Harvard and MIT.

Perspective on Growth: Excerpts from Local Growth Policy Statements, assembled by the Massachusetts Office of State Planning, January 1977.

Peterson, George. "The Effects of Zoning Regulation on Surburban Property Values," The Urban Institute, Working Paper #1207-24, March 1973.

Polinsky, A.M. and Shavell, S. "Amenities and Property Values in a Model of an Urban Area," Journal of Public Economics, Vol. 5, 1976, pp.119-129.

Polinsky, A.M. and Shavell, S. "The Air Pollution Property Value Debate," Review of Economics and Statistics, Vol. 57, Feb. 1975, pp.106-110.

Rhyne, Beth. "Regulations and the Cost of a House in Massachusetts," prepared for the Massachusetts Executive Office of Communities and Development, Boston, Massachusetts, May 1979.

Richardson, Dan K. The Cost of Environmental Protection. New Brunswick, New Jersey, Center for Urban Policy Research, 1976.

Ridker, R.G. and Henning, V.A. "The Determinants of Residential Property Value with Special Reference to Air Pollution," Review of Economics and Statistics, Vol. 49, 1967, pp.246-256.

Rosen, Sherwin. "Hedonic Prices and Implicit Markets," Journal of Political Economy, 82; 1, January/February 1974.

Schwartz, S. et al. "The Effect of Growth Management on New Housing Prices: Petaluma, California," Institute for Governmental Affairs, University of California at Davis, July 1979.

Seidel, Stephen R. Housing Costs and Government Regulations: Confronting the Regulatory Maze. New Brunswick: The Center for Urban Policy Research, 1978.

Solomon, Arthur. "The Effect of Land Use and Environmental Controls on Housing: A Review," Joint Center for Urban Studies of Harvard and MIT, Cambridge, Massachusetts, February 1976.

Straszheim, Mahlon. An Econometric Analysis of the Urban Housing Market, National Bureau of Economic Research, 1973.

Temple, Barker, Sloane, Inc. Water Utility Financing Study. Prepared for the Office of Drinking Water, U.S. Environmental Protection Agency, Washington, D.C., 1980.

U.S. Bureau of the Census. Current Population Reports, Series P-25, No. 873, "Estimates of the Population of Counties and Metropolitan Areas: July 1, 1977 and 1978," U.S. Government Printing Office, Washington, D.C., 1980.

U.S. Environmental Protection Agency. Mitigating Secondary Impacts from the Wastewater Facilities Program: An EPA Case Study Series, Washington, D.C., April 1977.

U.S. Environmental Protection Agency. The Status of Noise Control in the United States: State and Local Government. Washington, D.C., Office of Noise Abatement Control, April 1978.

Urban Land Institute and Gruen, Gruen & Associates, Effects of Regulation on Housing Costs: Two Case Studies. Washington: Urban Land Institute, 1977.

Urban Land Institute and Rice Center, The Cost of Delay Due to Government Regulation in the Houston Housing Market. Washington: Urban Land Institute, 1979.

Weidenbaum, Murry L. "Government Regulation and the Cost of Housing." Urban Land, February 1978, p.4.

APPENDIX B

PACE OF DEVELOPMENT MATRIX
BOSTON AREA CASE STUDY

COMMUNITY	PACE OF DEVELOPMENT				
	Single Family		Multi-Family		Federally subsidized units completed[4]
	Permits[1] 1978	Completions[2] 1979	Permits[1] 1978	Completions[3] 1979	
MIDDLESEX CO.					
CAMBRIDGE	67		57 du (2)		
EVERETT	6		0		
MALDEN	11	10	204 du (2)	0	
MEDFORD	7	2	216 du (2)		
MELROSE	7	10	3 du (1)	2	101 du
NEWTON	54	74	208 du (12)	6	124 du
SOMERVILLE	0		52 du (2)		
WALTHAM	52	75	281 du (12)	10	
WOBURN	77	60	11 du (1)	0	
ACTON	55	64	171 du (12)	0	
ARLINGTON	15	7	0	3	
ASHLAND	106		0		

PACE OF DEVELOPMENT MATRIX
BOSTON AREA CASE STUDY

COMMUNITY	PACE OF DEVELOPMENT				
	Single Family		Multi-Family		Federally subsidized units completed[4]
	Permits[1] 1978	Completions[2] 1979	Permits[1] 1978	Completions[3] 1979	
MIDDLESEX CO. (cont'd)					
BEDFORD	18	10	0	0	
BELMONT	5	4	0	2	
BOXBOROUGH	127	4	0	0	
BURLINGTON	38	48	0	0	
CARLISLE	38		0		
CONCORD	47		0		
FRAMINGHAM	115	124	3 du (1)	2	
HOLLISTON	49	30	0	0	
LEXINGTON	32	60	75 du (7)	0	
LINCOLN	33	58	0	0	
NATICK	40	40	178 du (26)		
NORTH READING	32	37	0	0	
READING	30		0		
SHERBORNE	28		0		
STONEHAM	46	69	79 du (2)	15	
SUDBURY	70		0		

COMMUNITY	PACE OF DEVELOPMENT				
	Single Family		Multi-Family		Federally subsidized units completed[4]
	Permits[1] 1978	Completions[2] 1979	Permits[1] 1978	Completions[3] 1979	
MIDDLESEX CO. (cont'd)					
WAKEFIELD	47		1074 du (10)		
WATERTOWN	1		4 du (1)		
WAYLAND	112		0		
WESTON	25		24 du (1)		
WILMINGTON	28	47	0	0	
WINCHESTER	27	48	0	0	120 du
NORFOLK CO.					
QUINCY	20	25	78 du (2)	5	213 du 156 du
BELLINGHAM	14		0		
BRAINTREE	145	30	0	1	
BROOKLINE	11		127 du (2)		
CANTON	65	54	30 du (1)	2	
COHASSET	21		0		
DEDHAM	43	46	0	3	
DOVER	32		0		

COMMUNITY	PACE OF DEVELOPMENT				
	Single Family		Multi-Family		Federally subsidized units completed[4]
	Permits[1] 1978	Completions[2] 1979	Permits[1] 1978	Completions[3] 1979	
NORFOLK CO. (cont'd)					
FOXBOROUGH	40	44	48 du (6)	0	
FRANKLIN	48	72	0	1	
HOLBROOK	10		0		
MEDFIELD	28	51	0	0	
MEDWAY	49		0		
MILLIS	47	15	0	0	
MILTON	19	24	128 du (1)	27	128 du
NEEDHAM	26	31	0	0	
NORFOLK	61		0		
NORWOOD	34		0		
RANDOLPH	60	48	36 du (2)	21 (du?)	
SHARON	99	97	0	0	
STOUGHTON	38		0		
WALPOLE	91		18 du (3)		
WELLESLEY	35	47	125 du (2)	0	
WESTWOOD	29		0		

BOSTON AREA CASE STUDY

COMMUNITY	PACE OF DEVELOPMENT				
	Single Family		Multi-Family		Federally subsidized units completed[4]
	Permits[1] 1978	Completions[2] 1979	Permits[1] 1978	Completions[3] 1979	
NORFOLK CO. (cont'd)					
WEYMOUTH	43		0		198 du (1978)
WRENTHAM	66		0		
PLYMOUTH CO.					
ABINGTON	11		0		
DUXBURY	118		5 du (1)		
HANOVER	26		0		
HANSON	31		0		
HINGHAM	77		0		198 du
HULL	2		0		
KINGSTON	42		0		
MARSHFIELD	61		0		
NORWELL	42		0		
PEMBROKE	49		0		
ROCKLAND	11		0		
SCITUATE	40		0		

BOSTON AREA CASE STUDY

COMMUNITY	PACE OF DEVELOPMENT				
	Single Family		Multi-Family		Federally sub-sidized units completed[4]
	Permits[1] 1978	Completions[2] 1979	Permits[1] 1978	Completions[3] 1979	
SUFFOLK CO.					
BOSTON	24	39	983 du (21)	16	96 du (1980) 242 du (1979) 775 du (1978) 188 du 216 du 220 du 129 du 96 du 223 du (1980) 42 du (1980) 277 du (1978) 312 du 138 du (1978)
CHELSEA	3		0		
REVERE	31		0		266 du
WINTHROP	1		166 du (1)		
ESSEX CO.					
BEVERLY	51	48	21 du (1)	0	232 du (1978)
LYNN	7		59 du (2)		
PEABODY	80		12 du (1)		173 du
SALEM	14		0	2	

COMMUNITY	PACE OF DEVELOPMENT				
	Single Family		Multi-Family		Federally subsidized units completed[4]
	Permits[1] 1978	Completions[2] 1979	Permits[1] 1978	Completions[3] 1979	
ESSEX CO. (cont'd)					
BOXFORD	37	55	0	0	
DANVERS	44	2	0	3	120 du
HAMILTON	36	16	0	0	
LYNNFIELD	38	20	0	0	
MANCHESTER	26	16	0	1	
MARBLEHEAD	26		0		
MIDDLETON	16		0		
NAHANT	0	2	0	0	
SAUGUS	65	38	0	10 (du)	
SWAMPSCOTT	7	0			
TOPSFIELD	28		0		
WENHAM	4		0		
NON-SMSA					
PLYMOUTH	313	218	0	5	
STOW	56		0		
PEPPERELL	99	37	0	1	

PACE OF DEVELOPMENT

COMMUNITY	Single Family		Multi-Family		Federally subsidized units completed[4]
	Permits[1] 1978	Completions[2] 1979	Permits[1] 1978	Completions[3] 1979	
NON-SMSA (cont'd)					
DUNSTABLE	9	17	0	0	
BILLERICA	62		0		
CARVER	80	58	0	0	
WAREHAM	109	56	0	0	
MARLBOROUGH	74	62	0	2	
ANDOVER	161		0		
ESSEX	9		0		
MAYNARD	8		5 du (1)		
MILFORD	70		0		
HAVERHILL	72		106 du (2)		183 du (1978) 117 du 97 du

NOTES TO PACE OF DEVELOPMENT MATRIX
BOSTON AREA CASE STUDY

1. Building permits recorded in 1978: number of units (number of developments, where known). Source: Mass. Department of Community Affairs.

2. Single family units completed in 1979. Source: Community Planning Departments, Town Clerks.

3. Multi-family developments completed in 1979. Source: Community Planning Departments, Town Clerks.

4. Number of units (number of developments). Year of completion is 1979 unless otherwise noted. Source: Boston Area Office, U.S. Department of Housing and Urban Development.

Community	STATE ENVIRONMENTAL REVIEW		Recently-Increased Sewerage Capacity[2]	Date of Entry Into Regular Phase, Nat'l Flood Ins. Program[3]	LOCAL DEVELOPMENT ORDINANCES[4]		
	Number of Developments reviewed under MEPA (1977-1978)[1]	No. of MEPA Developments in Coastal Zone Towns (1978-1979)[1]			No. Zones Permitting Multi-Family Development	No. Zones Requiring >43,560 sq. ft. Min. Lot Size	Special Zoning Provisions
MIDDLESEX CO.							
CAMBRIDGE					(a)	(a)	
EVERETT					(a)	(a)	
MALDEN					(a)	(a)	
MEDFORD	1				(a)	(a)	
MELROSE	2		Pump Station, Interceptor (1977)		(a)	(a)	
NEWTON	2				(a)	(a)	
SOMERVILLE					(a)	(a)	
WALTHAM	1		Interceptor (1977)		1	0	
WOBURN	2				3(S)	0	• Wetlands, Watershed Protection Districts • Cluster, PUD require (S) • Performance Standards • Apartments require (SPR)
ACTON	2			6/78	2	1	• Apartments require (SPR)
ARLINGTON					(a)	(a)	
ASHLAND					2(S)	0	• Wetland District • Cluster requires (S) • Performance standards • Erosion Control Provisions

INCIDENCE MATRIX-BOSTON AREA CASE STUDY

Community	STATE ENVIRONMENTAL REVIEW		Recently-Increased Sewerage Capacity[2]	Date of Entry Into Regular Phase, Nat'l Flood Ins. Program[3]	LOCAL DEVELOPMENT ORDINANCES[4]		
	Number of Developments reviewed under MEPA (1977-1978)[1]	No. of MEPA Developments in Coastal Zone Towns (1978-1979)[1]			No. Zones Permitting Multi-Family Development	No. Zones Requiring >43,560 sq. ft. Min. Lot Size	Special Zoning Provisions
MIDDLESEX CO. (cont'd)							
EDFORD				9/73 2/76 (map)	PUD(S)	1	• Wetland District • Cluster, PUD require (S)
ELMONT					(a)	(a)	
OXOROUGH				9/78	0	1	• Wetland District • Watershed Protection District
URLINGTON			(a)		1	0	• Apartments require (SPR)
ARLISLE					0	1	• Wetland Protection District
ONCORD				6/79	(b)	(b)	
RAMINGHAM	1		recent moratorium		0	0	• Wetlands District
OLLISTON					1(S)	0	• Wetlands District • Cluster • Performance standards • Apartments require (SPR)
EXINGTON	1			6/78	3(S)	0	• Wetland Protection District • Cluster permitted • Residential subdivisions require (SPR)
INCOLN				6/78	3(S)	0	• Watershed, Wetlands Protection District • Cluster permitted • Apartments require (SPR)

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INCIDENCE MATRIX-BOSTON AREA CASE STUDY

Community	STATE ENVIRONMENTAL REVIEW		Recently-Increased Sewerage Capacity[2]	Date of Entry Into Regular Phase, Nat'l Flood Ins. Program[3]	LOCAL DEVELOPMENT ORDINANCES[4]		
	Number of Developments reviewed under MEPA (1977-1978)[1]	No. of MEPA Developments in Coastal Zone Towns (1978-1979)[1]			No. Zones Permitting Multi-Family Development	No. Zones Requiring >43,560 sq. ft. Min. Lot Size	Special Zoning Provisions
MIDDLESEX CO. (cont'd)							
NATICK			recent moratorium		1	2	• PUD • Performance Standards
NORTH READING	1			4/78	1	3	• Wetlands Protection District • Cluster, PUD require (SPR) • Performance Standards • Erosion Runoff Controls in Wetlands District
READING	2		Collectors (1977)		(b)	(b)	
SHERBORNE					0	2	• Performance Standards • 3 residential districts restricted to SF development
STONEHAM					3	0	
SUDBURY					0	1	
WAKEFIELD			Forcemain, Collectors (1977)	10/78	3	0	• Apartments require (SPR)
WATERTOWN					(a)	(a)	
WAYLAND					0	0	• Watershed Protection • Cluster requires (S)
WESTON					2(S)	1	• Wetlands District • Cluster requires (S) • (SPR) required for all apartments, special permits, water supply protection

INCIDENCE MATRIX-BOSTON AREA CASE STUDY

Community	STATE ENVIRONMENTAL REVIEW				LOCAL DEVELOPMENT ORDINANCES[4]		
	Number of Developments reviewed under MEPA (1977-1978)[1]	No. of MEPA Developments in Coastal Zone Towns (1978-1979)[1]	Recently-Increased Sewerage Capacity[2]	Date of Entry Into Regular Phase, Nat'l Flood Ins. Program[3]	No. Zones Permitting Multi-Family Development	No. Zones Requiring >43,560 sq. ft. Min. Lot Size	Special Zoning Provisions
MIDDLESEX CO. (cont'd)							
WILMINGTON			Interceptor (1977)		0	1	
WINCHESTER	1				3	0	• Wetlands District • Cluster requires (S) • (S) for all apartments & developments in environmental districts
NORFOLK CO.							
QUINCY				9/73 7/76 (map)	(a)	(a)	
BELLINGHAM					1 (S)	1	• Cluster requires (S) • (SPR) required for projects including ≥20 parking spaces
BRAINTREE	1	1		6/78	2	0	• Wetlands Protection • Cluster required
BROOKLINE	1				(a)	(a)	
ANTON	1			4/78	2 (S)	1	• (SPR) required for apartment
OHASSET					(2)	(2)	
EDHAM					(2)	(2)	
OVER					0	1	

INCIDENCE MATRIX-BOSTON AREA CASE STUDY

Community	STATE ENVIRONMENTAL REVIEW				LOCAL DEVELOPMENT ORDINANCES[4]		
	Number of Developments reviewed under MEPA (1977-1978)[1]	No. of MEPA Developments in Coastal Zone Towns (1978-1979)[1]	Recently-Increased Sewerage Capacity[2]	Date of Entry Into Regular Phase, Nat'l Flood Ins. Program[3]	No. Zones Permitting Multi-Family Development	No. Zones Requiring >43,560 sq. ft. Min. Lot Size	Special Zoning Provisions
NORFOLK CO. (cont'd)							
FOXBOROUGH					1	0	• Wetlands District • Cluster PUD require (S) • Performance Standards
RANKLIN			• Charles River PCD (1976) • Interceptor, Pump Station (1976) o Collectors (1977)		0	0	• Performance Standards
OLBROOK			(a)		(S)	1	• (SPR) required with all (S)
EDFIELD			(Step 11 in 1976)	7/79	1	1	• Watershed Protection District • Cluster permitted • (SPR) required for all development
EDWAY			• Charles River PCD (1976) • Collectors (1976) • Collectors (1977)		(b) (b)	(b) (b)	AQUIFER RECHARGE
ILLIS					(b)	(b)	
ILTON				4/78	0	0	• Wetlands District • Cluster Permitted with (S)
EEDHAM				4/73 8/76 (map)	2	0	• Apartments require (SPR)
ORFOLK				8/71 10/76 (map)	(b)	(b)	• Performance Standards
ORWOOD	3				2(S)	2	
ANDOLPH			Collectors (1977)	5/78	1	0	• Watershed Protection District

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INCIDENCE MATRIX-BOSTON AREA CASE STUDY

Community	STATE ENVIRONMENTAL REVIEW				LOCAL DEVELOPMENT ORDINANCES[4]		
	Number of Developments reviewed under MEPA (1977-1978)[1]	No. of MEPA Developments in Coastal Zone Towns (1978-1979)[1]	Recently-Increased Sewerage Capacity[2]	Date of Entry Into Regular Phase, Nat'l Flood Ins. Program[3]	No. Zones Permitting Multi-Family Development	No. Zones Requiring >43,560 sq. ft. Min. Lot Size	Special Zoning Provisions
NORFOLK CO. (cont'd)							
SHARON	1			9/78	1(S)	2	• Water Resource, Aquifer Recharge Protection Districts • Housing Authority District • (SPR) required for development covering >10 acres
STOUGHTON	1		Collectors (1977)		2	0	• Watershed Protection, Aquifer Recharge Districts • Performance Standards • Cluster requires (S)
WALPOLE					0	0	
WELLESLEY	1			9/79	4	0	• Watershed Protection • Cluster, PUD permitted • Performance Standards • Townhouses require (SPR)
WESTWOOD			(2)	1/73 1/76 (map)	0	1	• Cluster permitted with (S) • Elderly apartments require (SPR)
WEYMOUTH	1	1	Collectors (1977)		3	0	• PUD require (S) • Apartments require (SPR)
WRENTHAM	1				2	1	• Watershed Protection District • Apartments require (SPR) • Local EIR required

INCIDENCE MATRIX-BOSTON AREA CASE STUDY

Community	STATE ENVIRONMENTAL REVIEW				LOCAL DEVELOPMENT ORDINANCES[4]		
	Number of Developments reviewed under MEPA (1977-1978)[1]	No. of MEPA Developments in Coastal Zone Towns (1978-1979)[1]	Recently-Increased Sewerage Capacity[2]	Date of Entry Into Regular Phase, Nat'l Flood Ins. Program[3]	No. Zones Permitting Multi-Family Development	No. Zones Requiring >43,560 sq. ft. Min. Lot Size	Special Zoning Provisions
PLYMOUTH CO.							
ABINGTON	1			9/77	(a)	(a)	
DUXBURY	1	1	Collectors (1977)	5/77	(b)	(b)	
HANOVER	1				0	0	• Aquifer Protection District (recent) • Wetland, Watershed Protection Districts • Performance Standards
HANSON					(a)	(a)	
HINGHAM	1	1			(b)	(b)	
HULL			Step III grant (unspecified) 1975		(a)	(a)	
KINGSTON					(a)	(a)	• Stringent on-site waste disposal regulations
MARSHFIELD			Treatment Plant (1977)	10/77	0	0	• Wetlands, Watershed Protection Districts • Cluster permitted with (S) (SPR) • Performance Standards, Erosion Control
NORWELL					0	2 districts require 40,000 - 43,560 ft^2	• Aquifer Protection District recent • Wetlands, Watershed Protection Districts • Erosion controls
PEMBROKE				11/79	3(S)	0	• Watershed Protection District • Performance Standards • Apartments require (SPR)

INCIDENCE MATRIX-BOSTON AREA CASE STUDY

Community	STATE ENVIRONMENTAL REVIEW		Recently-Increased Sewerage Capacity[2]	Date of Entry Into Regular Phase, Nat'l Flood Ins. Program[3]	LOCAL DEVELOPMENT ORDINANCES[4]		
	Number of Developments reviewed under MEPA (1977-1978)[1]	No. of MEPA Developments in Coastal Zone Towns (1978-1979)[1]			No. Zones Permitting Multi-Family Development	No. Zones Requiring >43,560 sq. ft. Min. Lot Size	Special Zoning Provisions
ESSEX CO. (cont'd)							
DANVERS					1	0	• Watershed Protection District
HAMILTON					2	1	• Apartments require (SPR)
LYNNFIELD					0	1	• Cluster permitted with (SPR)
MANCHESTER			Collectors (1977)		(b)	(b)	
MARBLEHEAD					(a)	(a)	
MIDDLETON					2(S)	1	• Performance Standards • Apartments require (SPR)
NAHANT				7/76	(b)	(b)	
SAUGUS	1				1	0	• Cluster, PUD require (SPR)
SWAMPSCOTT				9/76	(b)	(b)	
TOPSFIELD					0	1	
WENHAM					0	0	
NON-SMSA							
PLYMOUTH					(a)	(a)	
STOW				8/79	0	1	• Performance Standards
PEPPERELL					(a)	(a)	
DUNSTABLE				no problem	(a)	(a)	

INCIDENCE MATRIX-BOSTON AREA CASE STUDY

Community	STATE ENVIRONMENTAL REVIEW				LOCAL DEVELOPMENT ORDINANCES[4]		
	Number of Developments reviewed under MEPA (1977-1978)[1]	No. of MEPA Developments in Coastal Zone Towns (1978-1979)[1]	Recently-Increased Sewerage Capacity[2]	Date of Entry Into Regular Phase, Nat'l Flood Ins. Program[3]	No. Zones Permitting Multi-Family Development	No. Zones Requiring >43,560 sq. ft. Min. Lot Size	Special Zoning Provisions
NON-SMSA (cont'd)							
BILLERICA	1		Pump Station, Collectors (1976)		(b)	(b)	
CARVER					(a)	(a)	
WAREHAM	1			5/71 5/76 (map)	(a)	(a)	
MARLBOROUGH			Collectors (1976)		3(S)	0	
ANDOVER	1			8/78	(a)	(a)	
ESSEX					(b)	(b)	
MAYNARD	1				4	0	• Performance Standards • Apartments require (SPR)
MILFORD					0	2	• Performance Standards
HAVERHILL	1				(a)	(a)	

APPENDIX C

IMPACT OF ENVIRONMENTAL REGULATIONS ON HOUSING COSTS

Interview Guide

Developer ______________________________

Address ______________________________

Phone # ______________________________

Project ______________________________

Community ______________________________

Date of Interview ______________________________

Interviewer ______________________________

I. PROJECT DESCRIPTION

1. Where, exactly, is the development located?

2. What is the size (in acres) of the parcel?

3. What is the type of development? (multi-use, PUD, other?)

4. How many units have been completed in the development?

5. How many additional units are planned?

6. (If single family) What is the range of lot sizes in the development?

   From ________________ to ____________________ sq. ft.

7. (If multifamily) What is the range of the apartment/house sizes? (in sq. ft.)

   No. of Bedrooms: From ____ to ____

   No. of Baths: _________

   Parking provisions:

   Type of Construction: ________________

   Was landscaping provided? ____________

   Were special amenities provided:

   o for each unit (applicances, etc.) ____________________

   o for the development as a whole (recreation facilities, etc.) ____

8. (If "for-sale" housing) What was the price range of finished units?

   From $________________ for a _____-bedroom unit

   to $________________ for a _____-bedroom unit

9. (If rental housing) What is the rent schedule for finished units?

From $____________________ for a ____-bedroom unit

to $____________________ for a ____- bedroom unit

10. Have any of your development projects started in the last 5 years been terminated?

If yes, explain reasons for termination

Are the costs incurred in the terminated development reflected in costs of these units?

To what extent?

11. a) How many units are you currently building in all of your on-going projects?

b) How many people do you employ?

Office ______________________

Construction ________________

12 a) Were any subcontractors used in the development?

b) Who were they and what were their functions?

II. LAND ACQUISITION

1. When did you acquire the land for this development?

2. What was the previous use of the land?

3. Was the land available in one parcel or was the development parcel assembled from more than one lot?

4. Were the provided services adequate or did the developer have to supplement them? (If supplemented, describe.)
   - o water
   - o sewer
   - o roads
   - o other

5. What was the price paid for the unimproved land?

6. How was the land purchase financed?

   What was the closing date on the land purchase?

   For approximately how long, prior to this date, were activities related to the development of this project carried on?

   What were these activities?

   - o site planning
   - o soils, percolation tests
   - o assembling parcels
   - o others?

III. SITE PLANNING

1. What type of financing was used for land development in this project? (What were the terms of the financing agreement?)

2. When was the land development loan (if applicable) secured?

3. On what date was the general site plan first submitted to the Planning Board

4. Was any type of zoning change required?

5. If yes, when was application made to the Zoning Board?

6. What type of documentation/background materials were submitted with the application for zoning change?

7. On what date was zoning approval granted?

8. Was a public hearing held?

9. On what date was final approval of the site plan given by the Planning Board -- either of the general plan or of the first section to be built -- whichever was first?

10. Were any changes required of the site plan to obtain approval? If so, what? Why were the changes required?

11. Was an Environmental Notification Form filed with the Mass. Secretary of Environmental Affairs? When?

12. Did the project receive a notification of "no impact"? When?

13. If not, was an Environmental Impact Report filed? When? Who prepared the EIR? Who prepared other necessary documentation?

14. Were other environmental reviews required by the community? Under what authority were the reviews required?

(Such as, Floodplain, Wetlands, CZM)

How long did the review process take?

15. Were any changes made in project plans or designs as a result of these reviews?

16. If any environmental reviews were made, when was approval granted by the MEPA Office? By the community?

17. What permits were required?

	Agency	Date of Application	Date of Approval	Filing Fee	Documentation Required	Cost of Preparing Documentation	Comments
Local Permits:							
Building Permit							
Utility Connections							
Curb Cuts							
Septic Tank Approvals							
Well Approvals							
Shade Tree Permits							
Subdivision (Plot Approval							
Other							
State Permits:							
Wetlands							
NPDES							
Federal Permits:							
Dredge & Fill							

18. What were the costs of the following fees?

o Architect's Fee (design) $ ____________________

o Architect's Fee (supervision) $ ____________________

o Engineering Fee (design) $ ____________________

o Engineering Fee (supervision) $ ____________________

o Other $ ____________________

19. What carrying costs were incurred during the planning/ development phase of the project?

o Taxes on land $ ____________________

o Insurance $ ____________________

o Labor & Overhead (e.g., retaining employees while waiting for project approvals) $ ____________________

o Other $ ____________________

20. Were any new regulations affecting this project enacted by the local government during the planning or development phases? (Or within 6 months prior to planning and development?)

If yes, what?

How did they affect the project?

21. If you have been involved in developing in this community in the past, has the time required for approval of plans increased?

If yes, which steps are taking longer?

What do you attribute this to?

22. How does this community compare with other communities with which you have had dealings in terms of:

o time required to review plans

o requirements for information about a project

IV. SITE PREPARATION

1. Which of the following preparatory activities took place prior to construction of the units?

2. What were their costs?

3. Which of these activities (if any) were you required to perform differently than is customary as a result of special requirements imposed by local, state or federal governments?

Activity	Describe special government regulations	Normal length of time for performance	Actual length of time for performance	Materials/ equipment costs	Labor costs	Total costs
a) Site clearance						
b) Building Access Roads						
c) Grading of Slopes						
d) Other earth work						
e) Construction of underground storm drainage system						
f) Construction of holding ponds						
g) Construction of Sanitary Sewers/ Treatment						
h) Construction of septic tanks						
i) Other site utility construc'n						
j) Other improvements						

4. For each of the activities that resulted from more stringent than normal local government initiatives, describe the reasons/rationale for the requirements: (e.g., requiring leaching fields for on-site sanitary waste disposal that are larger than those required by Title V of the Mass. Sanitory Code):

5. At what stage in the plan approval process where these requirements imposed?

6. Was it necessary to redesign or re-engineer any parts of the project plans to meet these requirements?

7. What were the costs involved?

8. How have these costs affected the sale/rental price of the finished unit?

V. SITE CONSTRUCTION

1. What type of financing was used for construction? (What were the terms of the financial agreement?)

2. When was the construction loan secured?

3. For the portion of the development completed (or each phase of the project), please break down the construction costs in as disaggregated form as possible.

Activity	Materials	Labor	Total
Concrete			
Masonry			
Metals			
Rough Carpentry			
Finish Carpentry			
Waterproofing			
Insulation			
Roofing			
Sheet Metal			
Doors			
Windows			
Glass			
Lathe and Plaster			
Drywall			
Tile Work			
Accoustical			
Wood Flooring			
Resilient Flooring			
Painting and Decorating			
Specialties			
Cabinets			
Appliances			
Blinds and Shades, Artwork			

Activity	Materials	Labor	Total
Carpets			
Special Construction			
Elevators			
Plumbing and Hot Water			
Heat and Ventilation			
Air Conditioning			
Electrical Accessory Structures			
Roads and Walks			
Site Improvements			
Lawns and Planting			
Unusual Site Conditions			
General Requirements			
General Overhead			
Miscellaneous (Labor & Materials)			
Bond Premium			
Other Fees			

TOTAL COSTS ______________________________

OVERHEAD COSTS:

Activity	Total
Supervision	
Field Engineering	
Field Office Expertise	
Temporary Facilities	
Temporary Utilities	
Cleaning and Rubbish Removal	
Watchman Wages	

TOTAL OVERHEAD COSTS ______________________________

TOTAL CONSTRUCTION COSTS ______________________________

4. Which of these costs (if any) have increased over the last year, due to changes in government regulation (e.g., local building code changes, requirements for increased job supervision, equipment changes)? How much of an increase?

5. How have these costs affected the sale/rental prices of finished units?

6. How do you see these changes affecting the sales/rental prices of housing units built in this community in the future?

7. Do you expect any other qualitative changes in the future due to recent changes in government regulations (i.e., lot size, development size)?

APPENDIX D

DERIVATION OF INPUT AND INFLATIONARY COST IMPACTS ATTRIBUTABLE TO ENVIRONMENTAL REGULATIONS

INPUT COSTS

Because cost increases of building materials associated with Federal environmental legislation, could not be estimated directly, an alternative methodology was developed which utilized a study conducted by Data Resources, Inc. (DRI).[1] DRI estimated the impact of pollution control expenditures resulting from compliance with Federal air and water standards on the producer price index between 1970 and 1986. The analysis relied upon incremental abatement cost estimates provided by the Council on Environmental Quality for the same period. These costs included capital investment, annualized capital costs, and operating and maintenance costs by industry plus state and local costs associated with mobile source regulations. They are costs attributable solely to Federal environmental legislation and, as such, do not include expenditures by industry that would have been undertaken in the absence of regulatory action by the Federal government.

Producer price increases used in the current study, those for 1977, 1978 and 1979, are based upon analyses of both historical and forecast data. Thus, impact analysis prior to the third quarter of 1978 estimated how the national economy would have differed from its actual state had Federal environmental regulations not been in effect. Beyond this period, the baseline used for comparison was DRI's latest long term macroeconomic forecast. It is important to note that the forecast used deviates from economic growth that actually occurred in 1979 and 1980 in that the forecast showed modest economic weakness in 1979 and recovery in 1980. Unfortunately, the extent to which these deviations impact the producer price index cannot be easily determined. Despite these limitations, however, the DRI study is considered the best source of data for estimating price impacts of Federal environmental standards on building materials. As a result, Federal environmental regulations are assumed to increase the producer price index by 4.6 percent in 1977 and 1978, and by 4.5 percent in 1979 in this study.

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[1] The Macroeconomic Impact of Federal Pollution Control Programs: 1978 Assessment. Data Resources, Inc. submitted to the U.S. Environmental Protection Agency and the Council on Environmental Quality, Washington, D.C., January 1979.

To estimate abatement cost impacts on total residential development costs, a relatively simple methodology was devised. Regulatory costs associated with building materials, or input industries were derived by factoring the increase in the producer price index attributable to Federal environmental regulations into the total cost of materials expended for each development. Although conceptually simple, insufficient data were available to precisely estimate materials costs of each development directly. For example, only two developers were able to provide materials and labor costs, and in these cases labor costs from materials costs. In other cases, developers were unable or unwilling to detail these costs during interviews.

Materials costs associated with each development studied were therefore determined as follows. For cases B1 and B2, where developers provided combined materials and labor costs, materials costs were derived by applying a ratio of .65, established from the literature,[1] to the combined cost estimates. For cases B3, D1, D2 and D5, developers provided sufficient information about the phys- ical design of structures to enable estimation of materials costs through the Dodge Building Cost Calculator and Valuation Guide.[2] For cases B4, D3 and D4, only average selling prices were provided by developers. In these instances, materials costs were estimated as a percentage of sales price with secondary data.[3] The resulting cost impacts are shown in Exhibit D-1.

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[1] The Nation's Housing: 1975-1985. Joint Center for Urban Studies of MIT and Harvard University, Cambridge, Massachusetts.

[2] Dodge Building Cost Calculator and Valuation Guide, Edition 35, July-September, 1979, McGraw-Hill Incorporated, New York, N.Y., 1978.

[3] The Nation's Housing: 1975-1985. op.cit.

EXHIBIT D-1

DERIVATION OF INPUT COST INCREASES

Case	Total Projected Costs	Materials Cost Factor	Materials Cost	Year Construction Started	Increase in Producer's Index++	Materials Cost Due to Federal Environmental Regulations (Current $)	Materials Cost Due to Federal Environmental Regulations (1980 $)+++
Boston: B1	$8,235,450*	0.65	$5,353,000	1979	0.045	$230,500	$263,100
B2	2,516,000*	0.65	1,635,400	1977	0.046	71,900	99,500
B3	47,488**/unit x 172 units = 8,167,936	0.48	3,920,600	1979	0.045	168,800	192,700
B4	67,500**/unit x 65 units = 4,387,500	0.311	1,364,500	1978	0.046	60,000	77,100
Dallas: D1	53,483**/unit x 2200 units = 117,662,600	0.48	56,478,000	1979	0.045	2,432,100	2,776,000
D2	53,485**/unit x 1400 units = 74,876,200	0.48	35,940,600	1979	0.045	1,547,700	1,766,500
D3	59,000***/unit x 202 units = 11,918,000	0.311	3,706,500	1979	0.045	159,600	182,200
D4	212,000***/unit x 65 units = 13,780,000	0.311	4,285,600	1978	0.046	188,500	242,100
D5	3,032,400+	0.48	1,455,600	1979	0.045	62,700	71,600

*Total Materials and Labor Cost supplied by developer.

**Dodge Building Cost Calculator.

***Average sales price of units.

+Dodge Building Cost Calculator, with unit mix supplied by developer:

38 units @ $25,800 = $ 980,400
72 units @ $28,500 = 2,052,000 Total = $3,032,400

++The Macroeconomic Impact of Federal Pollution Control Programs: 1978 Assessment. Data Resources, Inc., submitted to the Environmental Protection Agency and the Council on Environmental Quality, January 1979.

+++Cost estimates converted to 1980 dollars using the Producer Price Index.

INFLATION

Inflation costs associated with developments reviewed in this study were derived from construction cost indices published by the Engineering News Record (Specific construction cost indices are published for both Boston and Dallas.) These costs were estimated by applying ratios, calculated by dividing the construction cost index at the time the project was completed by the index at the time of project initiation, to total project construction costs. Total construction costs included labor and materials costs associated with the construction of residential structures plus labor and materials costs associated with land development and lot preparation. Exhibit D-2 details the calculations used to estimate inflationary costs for each project reviewed in this study.

Additional analysis in this appendix relates to attempts to more precisely define inflationary impacts on project costs. As th concept of "delay" was difficult to define in practical terms, inflationary impacts were alternatively calculated over a delay period specified as the difference between observed project review time and expected project review time, where expected review time was a subjectively determined interval based upon assessments of the planning process in each area. Where project review times in case studies exceeded expected review times, inflationary costs were calculated over the time that the expected, or nominal review period was exceeded through to the initiation of project construction. These estimates are shown in Exhibit D-3.

While the construction cost index reflects inflationary impacts in an absolute sense, it fails to reveal the relative impacts of regulatory delays on construction costs compared to inflation in the economy as a whole. In other words, the index, as applied, fails to measure construction cost inflation in real terms. To investigate this argument, the proportional change in the construction cost index over the review periods of each case study was compared to the proportional change in the implicit price deflator for the Gross National Product over the same period and applied to estimated construction costs. The resulting estimates of real cost impacts attributable to regulatory delay are shown in Exhibit D-4.

EXHIBIT D-2

DERIVATION OF INFLATION COSTS

	(a)	(b)	(c)	(d)	(e)	(f)	
Case	Start of Planning Period	ENR Index*	Start of Construction**	ENR Index*	Estimated Construction Costs	Inflation Costs (Current $)	(1980 $)***
Boston: B1	February 1973	172.89	June 1979	262.38	$ 8,724,800	$ 2,975,800	3,263,000
B2	January 1977	220.85	September 1977	237.33	2,516,000	174,700	211,800
B3	December 1977	244.99	September 1979	276.08	20,799,600	2,342,300	2,440,900
B4	March 1972	151.65	February 1977	220.85	3,202,900	1,003,600	1,307,400
Dallas: D1	August 1974	177.15	June 1975	185.76	85,893,700	3,981,200	6,166,000
D2	June 1976	204.07	April 1979	255.71	54,660,200	11,038,500	12,419,400
D3	June 1977	219.96	January 1978	238.99	4,953,100	394,400	474,800
D4	April 1978	241.27	May 1978	244.33	10,059,400	126,000	148,400
D5	July 1976	235.77	December 1978	257.55	4,588,900	388,100	433,500

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*Engineering News Record, Building Cost Index for the months indicated.

**Although a more complete estimate of inflation should include time elapsed for construction, dates for final project complete were not always available due to project segmentation. Therefore, the month of construction start was used, since it is a relatively consistently defined figure.

***Costs converted to 1980 dollars using ENR Building Cost Index.

EXHIBIT D-3

SENSITIVITY ANALYSIS: ASSUMPTION OF NOMINAL PLANNING REVIEW PERIOD

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	
Case	Start of Planning Period	End of Nominal Planning Period	ENR Index*	Start of Construction	ENR Index*	Estimated Construction Costs	Inflation Costs (Current $)	(1980 $)***
Boston: B1	February 1973	August 1973	170.72	June 1979	262.38	$ 8,724,800	3,047,900	3,342,100
B2	January 1977	July 1977	226.65	September 1977	237.33	2,516,000	113,200	137,300
B3	December 1977	June 1978	244.70	September 1979	276.08	20,799,600	2,364,100	2,463,600
B4	March 1972	September 1972	156.49	February 1977	220.85	3,202,900	933,400	1,215,900
Dallas: D1	August 1974	November 1974	176.16	June 1975	185.76	85,893,700	- 4,439,100	6,875,200
D2	June 1976	September 1976	212.15	April 1979	255.71	54,660,200	9,311,300	10,476,200
D3	June 1977	September 1977	237.33	January 1978	238.99	4,953,100	34,400	41,400
D4	April 1978	April 1978**	241.27	May 1978	244.33	10,059,400	126,000	148,300
D5	July 1976	October 1976	212.15	December 1978	257.55	4,588,900	808,900	903,600

*Engineering News Record, Building Cost Index for the months indicated.

**This project was reviewed over a two week period, and construction started immediately thereafter. No assumption of nominal review time was necessary.

***Costs converted to 1980 dollars using ENR Building Cost Index.

SENSITIVITY ANALYSIS: REAL INFLATION COSTS
(CONSTRUCTION COST INCREASES RELATIVE TO OVERALL RATE OF INFLATION)

Case		Start of Planning Period	End of Nominal Planning Period	ENR Index* (1967=100)	GNP Implicit Price Deflator+ (1972=100)	Start of Construction	ENR Index (1967=100)	GNP Implicit Price Deflator (1972=100)	Estimated Construction Cost	Real Inflation Costs	
										(Current $)++	(1980 $)+++
Boston:	B1	February 1973	August 1973	170.72	106.57	June 1979	262.38	163.81	8,724,800	-1,200	1,300
	B2	January 1977	July 1977	226.65	142.59	September 1977	237.33	142.59	2,516,000	113,200	137,300
	B3	December 1977	June 1978	244.70	150.82	September 1979	276.08	167.20	20,799,600	361,900	377,200
	B4	March 1972	September 1972	156.49	100.29	February 1977	220.85	138.34	3,202,900	72,300	94,200
Dallas:	D1	August 1974	November 1974	176.16	121.06	June 1975	185.76	125.96	85,893,700	1,142,000	1,768,700
	D2	June 1976	September 1976	212.15	134.56	April 1979	255.71	163.81	54,660,200	-546,400	-614,800
	D3	June 1977	September 1977	237.33	142.59	January 1978	238.99	147.05	4,953,100	-119,400	-143,800
	D4	April 1978	April 1978**	241.27	150.82	May 1978	244.33	150.82	10,059,400	126,000	148,300
	D5	July 1976	October 1976	212.15	134.56	December 1978	257.55	156.68	4,588,900	187,500	209,500

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*Engineering News Record, Building Cost Index for the months indicated.

**This project was reviewed over a two week period, and construction started immediately thereafter. No assumption of nominal review time was necessary.

+U.S. Department of Commerce, Survey of Current Business.

++Current dollar real inflation costs = Contruction cost$_t$ $\left[1 - \frac{ENR_{t-1} * GNP_t}{ENR_t * GNP_{t-1}}\right]$

+++Current dollar costs converted to 1980 dollars using ENR Building Cost Index.